No. 8260

JVC Service Manual

COMPACT VIDEO CASSETTE RECORDER VHS PAL

MODEL HR-C3E

BATTERY CHARGER
MODEL BB-P3E

AC POWER PACK
MODEL AC-P3E

CAR BATTERY ADAPTER
MODEL AP-P3E

CASSETTE ADAPTER
MODEL C-P2U

VICTOR COMPANY OF JAPAN, LIMITED

No. 8260(1/5)

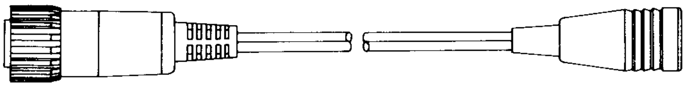
JVC Service Manual

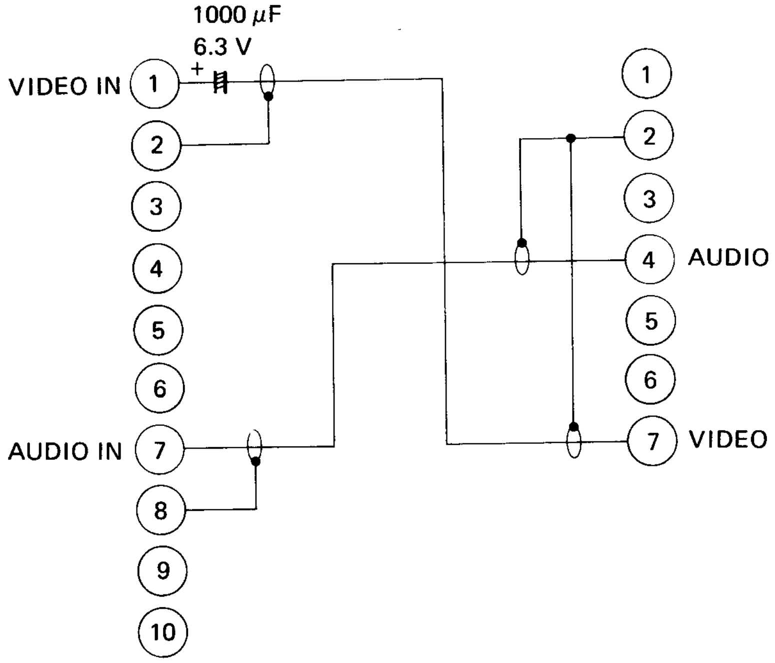
PHONES
MIC
EJECT
REMOTE
CAMERA
PAUSE
PLAY
REC
STOP
REW
FF
SHUTTLE SEARCH
AUDIO DUB
JVC
OFF ON
REC LOCK
DC POWER
REMAINING

MODEL HR-C3E

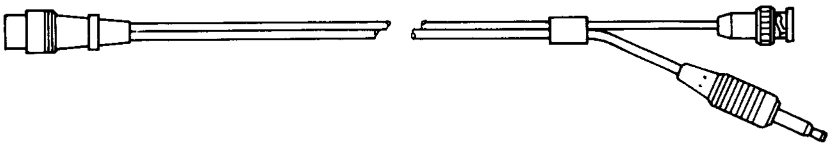
VICTOR COMPANY OF JAPAN, LIMITED

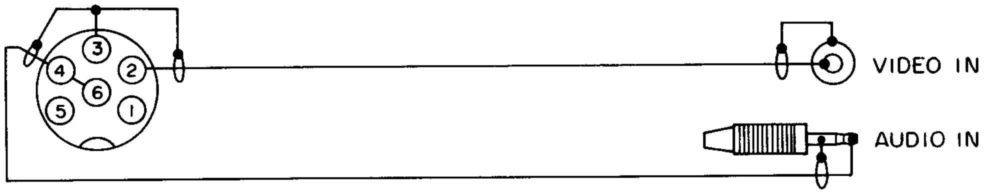
VC-P32U Tuner Cable



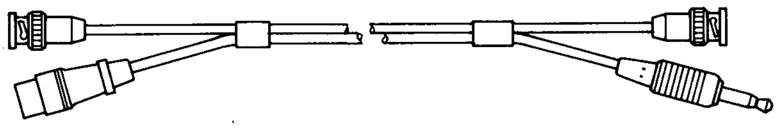

1000 μF
6.3 V
+
VIDEO IN
1
2
3
4
5
6
AUDIO IN
7
8
9
10
1
2
3
4
AUDIO
5
6
7
VIDEO

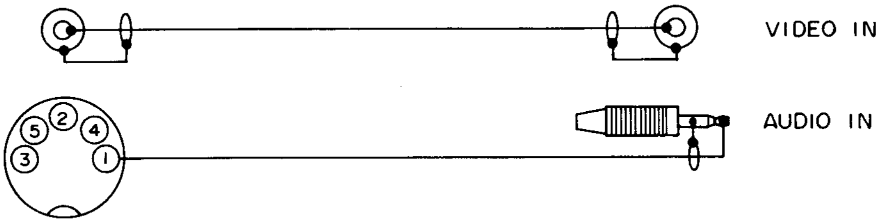
VC-P33E A/V Cable




3
2
4
6
5
1
VIDEO IN
AUDIO IN

VC-P34E A/V Cable




VIDEO IN
2
5
4
3
1
AUDIO IN

Important Safety Precautions

Prior to shipment from the factory, JVC products are strictly inspected to conform with the recognized product safety and electrical codes of the countries in which they are to be sold. However, in order to maintain such compliance, it is equally important to implement the following precautions when a set is being serviced.

● Precautions during Servicing

1. Locations requiring special caution are denoted by labels and inscriptions on the cabinet, chassis and certain parts of the product. When performing service, be sure to read and comply with these and other cautionary notices appearing in the operation and service manuals.

2. Parts identified by the ⚠ symbol and shaded (▨) parts are critical for safety.
   Replace only with specified part numbers.
   Note: Parts in this category also include those specified to comply with X-ray emission standards for products using cathode ray tubes and those specified for compliance with various regulations regarding spurious radiation emission.

3. Use specified internal wiring. Note especially:
   1) Wires covered with PVC tubing
   2) Double insulated wires
   3) High voltage leads

4. Use specified insulating materials for hazardous live parts. Note especially:
   1) Insulation Tape
   2) PVC tubing
   3) Spacers
   4) Insulation sheets for transistors

5. When replacing AC primary side components (transformers, power cords, noise blocking capacitors, etc.) wrap ends of wires securely about the terminals before soldering.

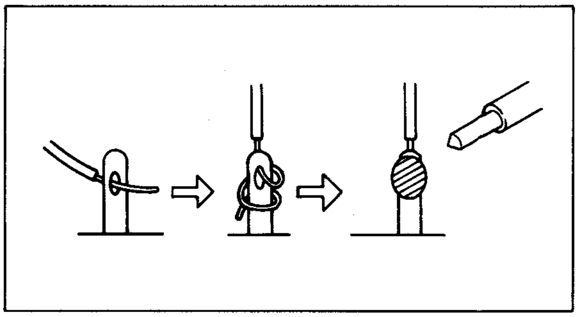


Fig. 1

6. Observe that wires do not contact heat producing parts (heatsinks, oxide metal film resistors, fusible resistors, etc.)

7. Check that replaced wires do not contact sharp edged or pointed parts.

8. When a power cord has been replaced, check that 10–15 kg of force in any direction will not loosen it.

9. Also check areas surrounding repaired locations.

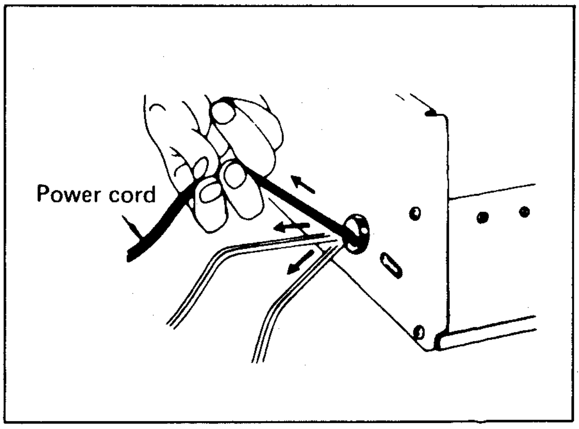


Fig. 2

10. Products using cathode ray tubes (CRTs)
    In regard to such products, the cathode ray tubes themselves, the high voltage circuits, and related circuits are specified for compliance with recognized codes pertaining to X-ray emission. Consequently, when servicing these products, replace the cathode ray tubes and other parts with only the parts specified. Under no circumstances attempt to modify these circuits. Unauthorized modification can increase the high voltage value and cause X-ray emission from the cathode ray tube.

11. Crimp type wire connector

In such cases as when replacing the power transformer in sets where the connections between the power cord and power transformer primary lead wires are performed using crimp type connectors, if replacing the connectors is unavoidable, in order to prevent safety hazards, perform carefully and precisely according to the following steps.

1. Connector part number : E03830-001
2. Required tool : Connector crimping tool of the proper type which will not damage insulated parts.
3. Replacement procedure
    1) Remove the old connector by cutting the wires at a point close to the connector. Important : Do not reuse a connector (discard it).
    2) Strip about 15 mm of the insulation from the ends of the wires. If the wires are stranded, twist the strands to avoid frayed conductors.
    3) Align the lengths of the wires to be connected. Insert the wires fully into the connector.
    4) As shown in Fig. 6, use the crimping tool to crimp the metal sleeve at the center position. Be sure to crimp fully to the complete closure of the tool.
    5) **Check the four points noted in Fig. 7.**

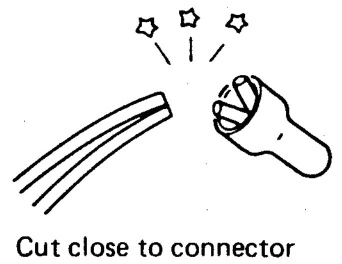

Cut close to connector

Fig. 3

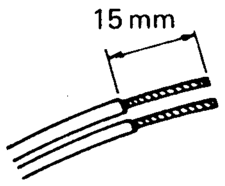


Fig. 4

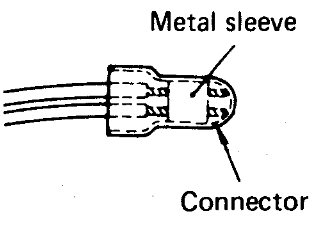

Metal sleeve
Connector

Fig. 5

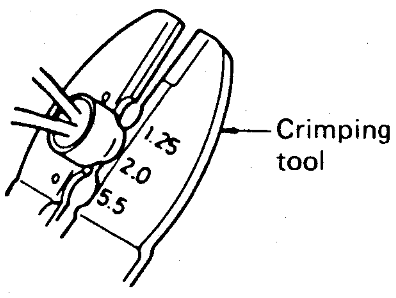

1.25
2.0
5.5
Crimping tool

Fig. 6

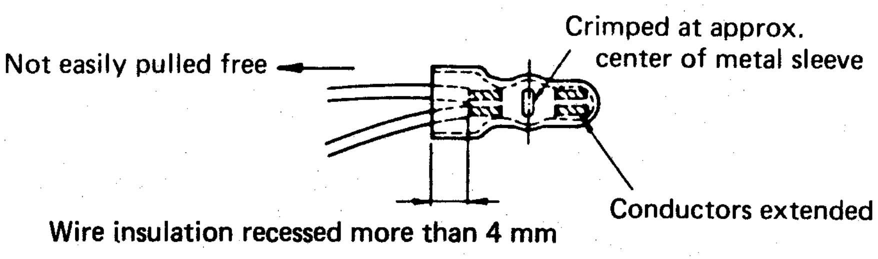

Crimped at approx. center of metal sleeve
Not easily pulled free
Conductors extended
Wire insulation recessed more than 4 mm

Fig. 7

● Safety Check after Servicing

Examine the area surrounding the repaired location for damage or deterioration. Observe that screws, parts and wires have been returned to original positions. Afterwards, perform the following tests and confirm the specified values in order to verify compliance with safety standards.

1. **Insulation resistance test**
   Confirm the specified insulation resistance or greater between power cord plug prongs and externally exposed parts of the set (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.). See table below.

2. **Dielectric strength test**
   Confirm specified dielectric strength or greater between power cord plug prongs and exposed accessible parts of the set (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.) See table below.

3. **Clearance distance**
   When replacing primary circuit components, confirm specified clearance distance (d),(d') between soldered terminals, and between terminals and surrounding metallic parts. See table below.

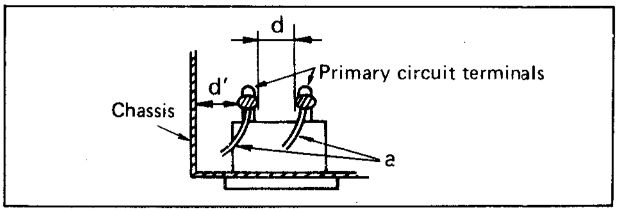


Fig. 8

Table 1: Ratings for selected areas

AC Line Voltage	Region	Insulation Resistance	Dielectric Strength	Clearance Distance (d),(d')
100 V	Japan	≧ 1 MΩ/500 V DC	1 kV 1 minute	≧ 3 mm
110 to 130 V	USA & Canada	– – –	900 V 1 minute	≧ 3.2 mm
* 110 to 130 V 200 to 240 V	Europe Australia	≧ 10 MΩ/500 V DC	4 kV 1 minute	≧ 6 mm (d) ≧ 8 mm (d') (a: Power cord)

* Class Π model only.

Note. This table is unofficial and for reference only. Be sure to confirm the precise values for your particular country and locality.

4. **Leakage current test**
   Confirm specified or lower leakage current between B(earth ground, power cord plug prongs) and externally exposed accessible parts (RF terminals, antenna terminals, video and audio input and output terminals, microphone jacks, earphone jacks, etc.).

   Measuring Method: (Power ON)
   Insert load Z between B(earth ground,power cord plug prongs) and exposed accessible parts. Use an AC voltmeter to measure across both terminals of load Z. See figure and following table.

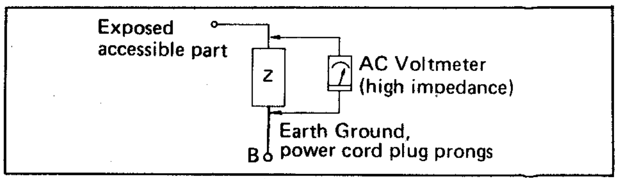
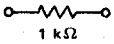
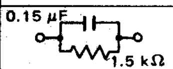
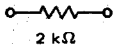
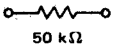

Exposed accessible part
Z
AC Voltmeter (high impedance)
Earth Ground, power cord plug prongs
B

Fig. 9

Table 2: Leakage current ratings for selected areas

AC Line Voltage	Region	Load Z	Leakage Current (i)	Earth Ground (B) to:
100 V	Japan	 1 kΩ	i ≦ 1m A rms	Exposed accessible parts
110 to 130 V	USA & Canada	 0.15 µF 1.5 kΩ	i ≦ 0.5m A rms	Exposed accessible parts
110 to 130 V 200 to 240 V	Europe Australia	 2 kΩ	i ≦ 0.7 m A peak i ≦ 2 m A dc	Antenna earth terminals
		 50 kΩ	i ≦ 0.7 m A peak i ≦ 2 m A dc	Other terminals

Note. This table is unofficial and for reference only. Be sure to confirm the precise values for your particular country and locality.

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HR-C3E

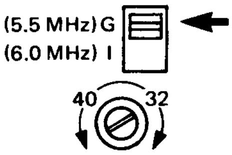
INSTRUCTIONS

For reference, the text of the instruction booklet of this model is reproduced in the following pages.
Numbering of the pages also corresponds with that of the booklet.
There are minor differences, mostly pertaining to accessories, tuner and power supply specifications, etc. between models with "EG" and "EK" suffixes.
These are also noted in the following pages.

WARNING

This set is for exclusive use with the PAL colour system.
Connect a video camera built to the PAL standard.

CAUTION:
To prevent shock, do not open the cabinet. No user serviceable parts inside. Refer servicing to qualified personnel.



ATTENTION:
The system select switch on the bottom of the unit has been set to G (Continental PAL, 5.5 MHz).

VHSC
PAL

This compact video cassette recorder is designed exclusively for the VHSC video cassette. Only cassettes marked VHSC can be used with this recorder.

WARNING:
TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS UNIT TO RAIN OR MOISTURE.

This unit should be used with 12 V DC only.
CAUTION:
To prevent electric shocks and fire hazards, do NOT use any other power source.

IMPORTANT: It is permissible to record television programmes only in the event that third party copyrights and other rights are not violated.

NOTE:
The rating plate (serial number plate) and the safety caution are on the bottom of the unit.

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Thank you for purchasing the JVC **HR-C3**, a VHS recorder that is truly portable. The **HR-C3** is specially designed for use in combination with a video camera and can be connected directly to a television receiver for playback. Because the **HR-C3** is compatible with other VHS machines, the VHS-C tapes recorded by the **HR-C3** can be played back with a regular VHS machine using a cassette adapter or conveniently be dubbed to standard VHS tapes for home viewing. Because of its light weight and compact size, we are sure that you will find the **HR-C3** ideal for use wherever you go and that it will help you add variety to your video programming.

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FEATURES

Recording/Playback
Up to 30 minutes of fully VHS-compatible recording and playback is possible with a single VHS compact video cassette.

RF converter
With its built-in RF converter that can be tuned to UHF channels 32 – 40, the **HR-C3** can be connected directly to the antenna terminal of a TV set, for playback of recorded material. Switchable between G system (5.5 MHz) and I system (6.0 MHz).

Automatic backspace editing
When the camera's stop button is pressed during recording, the tape is automatically backspaced slightly. When recording is resumed, the video signal of the continuing sequence is recorded exactly at the point where the previous section was stopped. This all but eliminates picture distortion between the two recorded sequences.

Automatic quick review function
When the tape is being backspaced, if the camera has an electronic viewfinder or if the **HR-C3** is connected to a video monitor, the last second of the recording will be seen in reverse. This allows you to check that satisfactory recording was made.

Standby mode lock
With the convenient recording standby mode lock, even when the power is switched off between separately recorded sequences, the new sequence is synchronized with the previously recorded sequence so that virtually no distracting picture distortion results when recording resumes.

Audio dubbing
The audio dubbing facility makes recording a new soundtrack possible – narration from a microphone, for example – onto an already recorded programme.

Two-way shuttle search
So that any recorded sequence can be located quickly, the tape can be fast forwarded or rewound at three times normal speed with the picture visible on a TV screen or in the camera's electronic viewfinder.

Full-function remote control
The full-function remote control gives control over all tape functions including shuttle search and audio dubbing as well as power on/off from a distance.

Switchable LCD counter
This low power-consuming tape counter has a memory function for quick location of a predetermined point on the tape (the counter reading of around "0000") and can be switched to show the remaining time left for recording.

Flexible power supply
An ingenious power supply system is employed; the power supply units slide onto the rear panel of the **HR-C3** and click into position. The standard battery pack has a capacity of 0.7 AH, enough to power the **HR-C3** and a video camera for 30 minutes. An exclusive battery charger is provided to charge this battery pack (in approx. 60 min.) and the optional 50-minute 1.2 AH high-capacity battery pack (in approx. 90 min.). Two other power supply units are available; the AC power pack and the car battery adapter.

PRECAUTIONS

Handling and storage

- Prevent inflammables, water and metallic objects from entering the unit.
- Do not disassemble or modify the unit, as this will cause danger and malfunctioning.
- Do not use the unit when there is lightning in the vicinity and exercise special care not to allow the unit to become wet when shooting outdoors on rainy days.
- Do not place heavy objects on the unit.
- Do not subject the unit to vibrations or shocks.
- Do not subject the unit to direct sunlight or place it near a heater for a long period of time, otherwise the cabinet may become deformed or the internal electronic components such as transistors may be damaged. Pay special attention to rising temperature in closed cars on hot summer days; the temperature in closed cars sometimes reaches as high as 80°C .
- Avoid using the unit under the following conditions:
  - – Extremely hot or cold places
  - – Near appliances generating strong magnetic fields
  - – Moving from a cold to a warm place
  - – Places subject to excessive humidity, dust or vibrations.

Moisture condensation

You have observed that pouring a cold liquid into a glass will cause drops of water to form on the glass's outer surface. This same phenomenon occurs on the head drum of a video recorder when the recorder is moved from a warm place to a cool place. Moisture on the head drum can cause severe damage to the video tape, and can lead to internal damage to the recorder itself. If moisture condensation occurs on the head drum, the DEW indicator lights. In such a case, be especially careful to allow sufficient time for it to dry before operating the machine. See page 16.

Maintenance

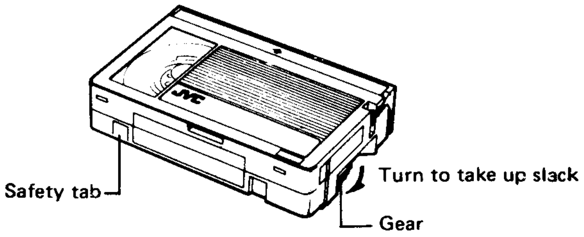
- When the cabinet is dusty, clean by gently wiping with a soft cloth.
- Avoid the use of strong cleaning agents such as benzine or alcohol as they may damage the cabinet.

Serious malfunctioning

If malfunctioning occurs, stop using the unit immediately and consult your local JVC dealer.

Video cassettes

- The **HR-C3** employs compact video cassettes carrying the VHS-C mark only.
- Recording onto prerecorded tapes automatically erases the previously recorded video and audio signals.
- An inverted cassette cannot be inserted.
- Do not load and unload the cassette repeatedly without allowing the tape to run at all. This will slacken the tape and thereby damage it.
- Make certain before loading the cassette that the tape is not slackened. If there is any slack, turn the gear on the cassette in the direction of the arrow to take up slack.
- The cassette is equipped with a safety tab to prevent accidental erasure. When the tab is removed, recording is impossible. If you wish to record on a cassette whose tab has been removed, use adhesive tape to reseal the slot.

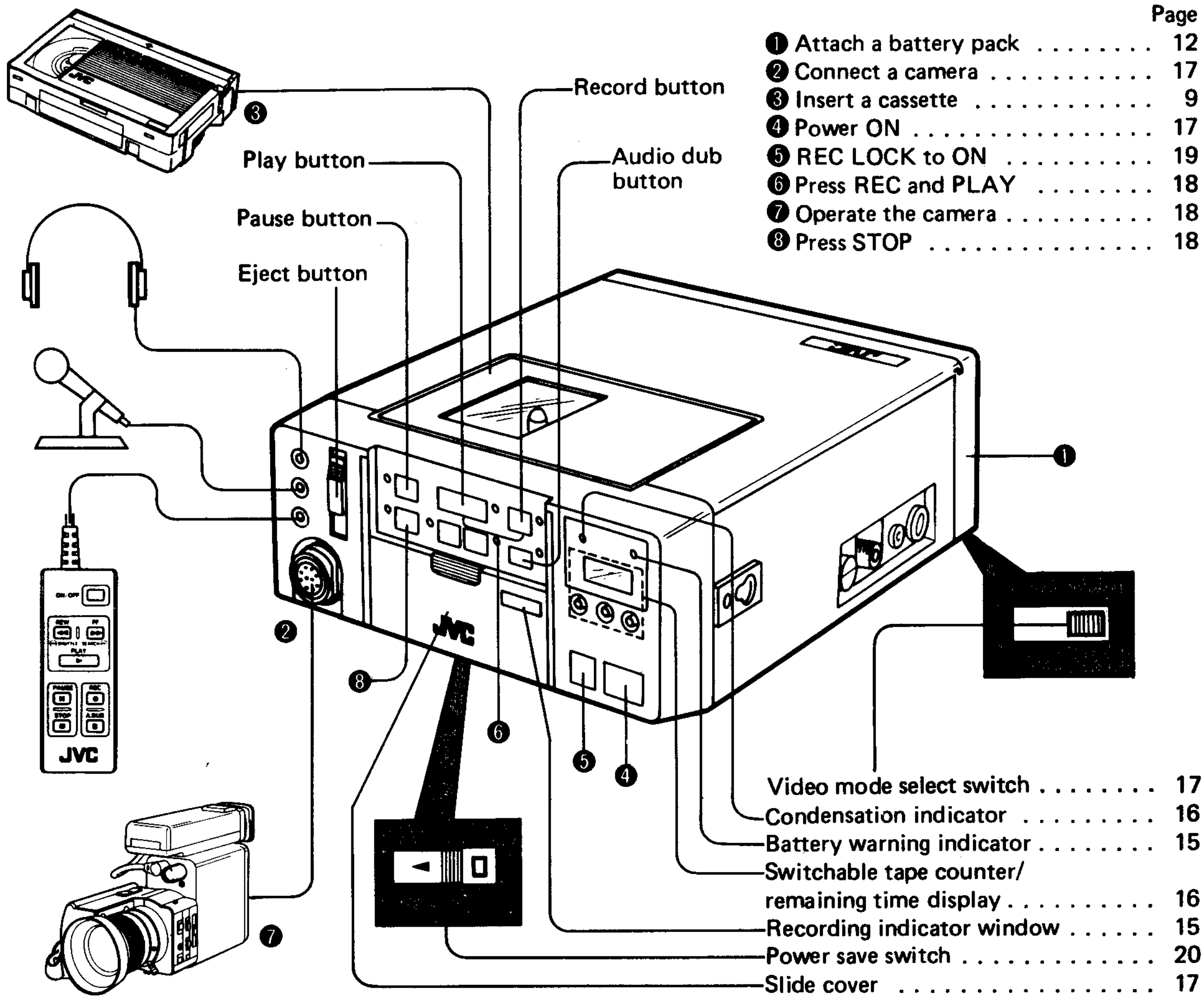


- To avoid excessive exposure to dust and fingerprints, do not open the front tape cover.

Storage of cassettes

- Avoid exposing the cassettes to direct sunlight. Keep them away from heaters.
- Avoid storing the cassettes in humid or dusty places.
- Do not drop the cassettes. Do not expose them to violent vibrations or shocks.
- Do not expose the cassettes to strong magnetic fields (near a motor, transformer or magnet).
- Place the cassettes in cassette cases and position them vertically.

BASIC OPERATION PROCEDURE – RECORDING WITH A CAMERA

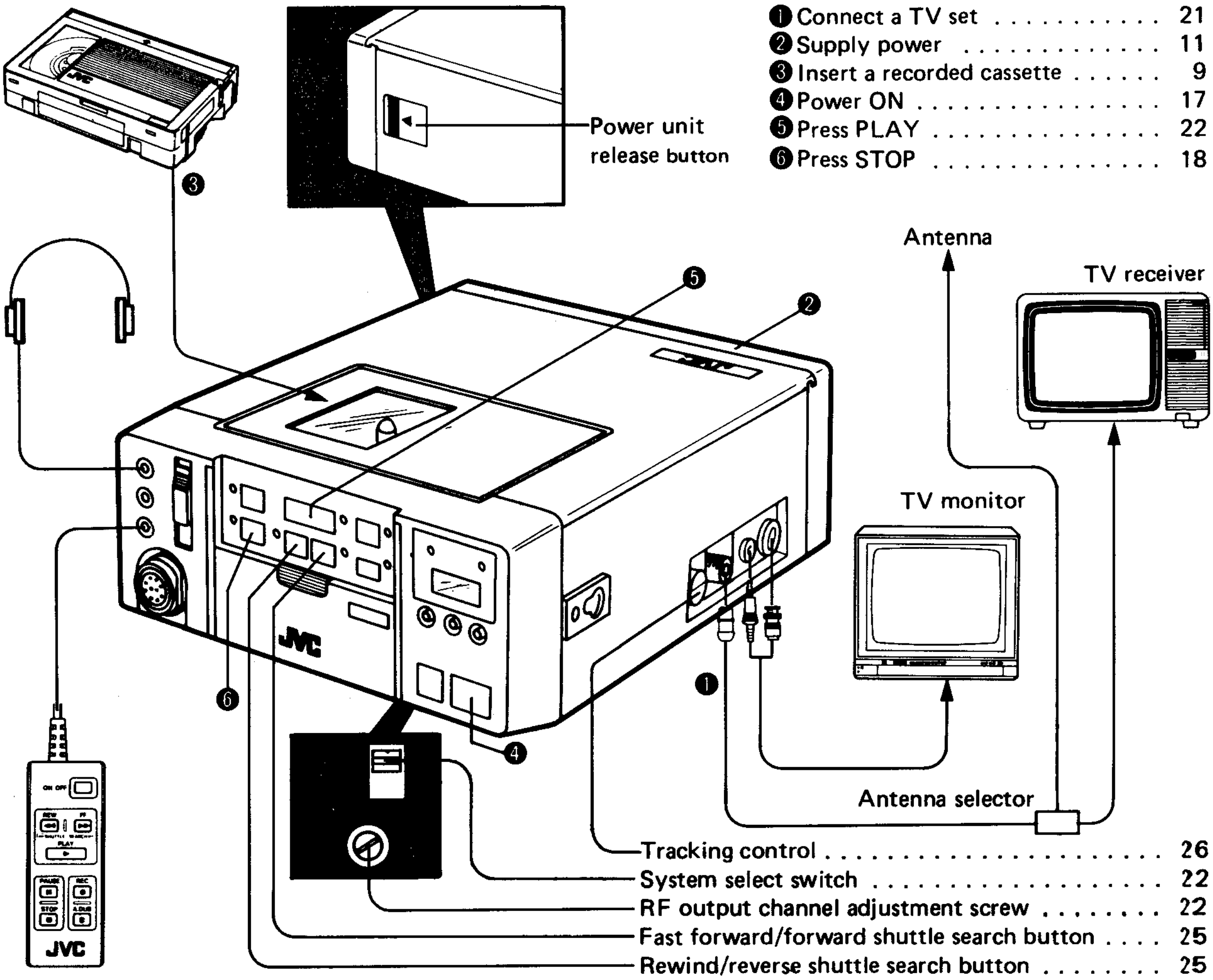

❸
Play button
Pause button
Eject button
Record button
Audio dub button
❶
❷
❽
❻
❺
❹
❼
JVC

	Page
❶ Attach a battery pack	12
❷ Connect a camera	17
❸ Insert a cassette	9
❹ Power ON	17
❺ REC LOCK to ON	19
❻ Press REC and PLAY	18
❼ Operate the camera	18
❽ Press STOP	18

Video mode select switch	17
Condensation indicator	16
Battery warning indicator	15
Switchable tape counter/ remaining time display	16
Recording indicator window	15
Power save switch	20
Slide cover	17

BASIC OPERATION PROCEDURE – PLAYBACK

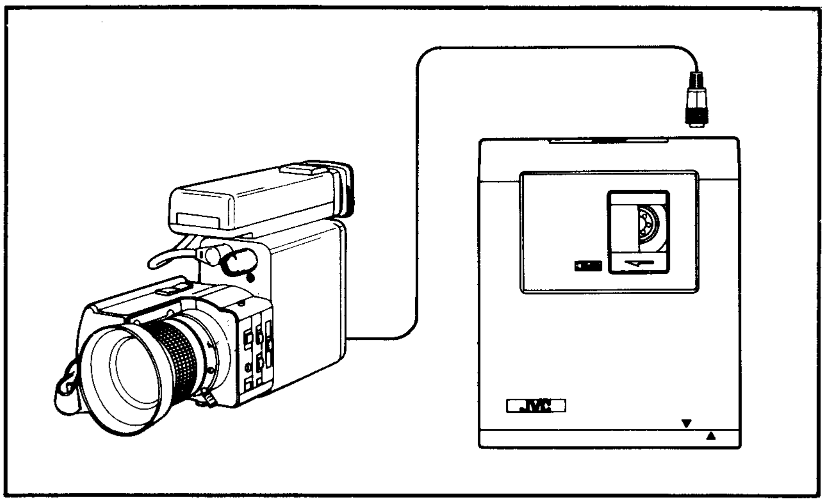
	Page
❶ Connect a TV set	21
❷ Supply power	11
❸ Insert a recorded cassette	9
❹ Power ON	17
❺ Press PLAY	22
❻ Press STOP	18


Power unit release button
Antenna
TV receiver
TV monitor
Antenna selector
❶
❷
❸
❹
❺
❻
JVC
ON OFF
REW
FF
PLAY
PAUSE
REC
STOP
A.DUB

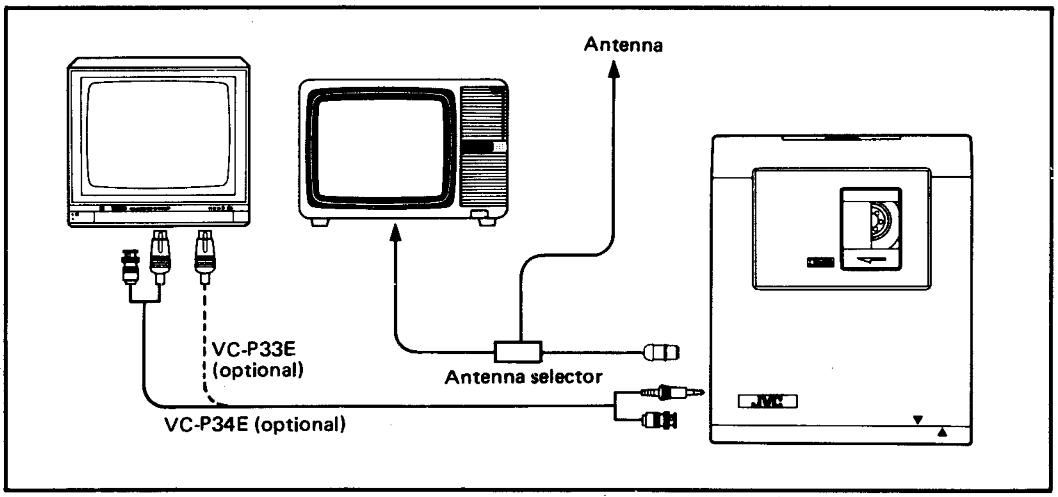
Tracking control	26
System select switch	22
RF output channel adjustment screw	22
Fast forward/forward shuttle search button	25
Rewind/reverse shuttle search button	25

WAYS THE HR-C3 CAN BE USED

1 **Connect a camera for recording.**



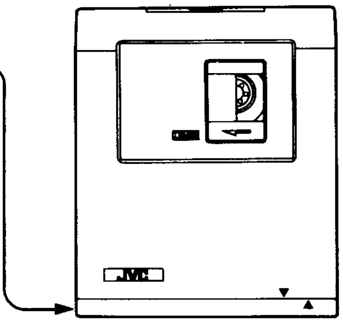
2 **Playback**


Antenna
VC-P33E (optional)
Antenna selector
VC-P34E (optional)
JVC

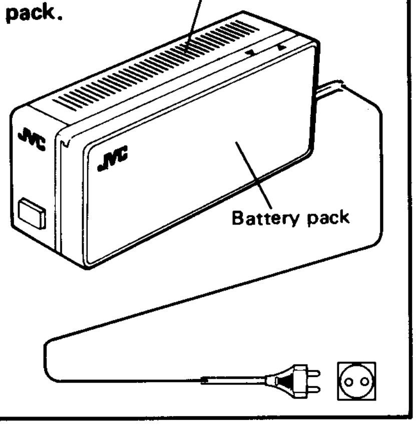
3 There are various power supply options.

- Regular battery pack NB-P3U (0.7 AH) (standard)
- High-capacity battery pack NB-P4U (1.2 AH) (optional)
- AC power pack *AC-P3EG (optional)
- Car battery adapter AP-P3E (optional)

*AC-P3EK for "EK" model

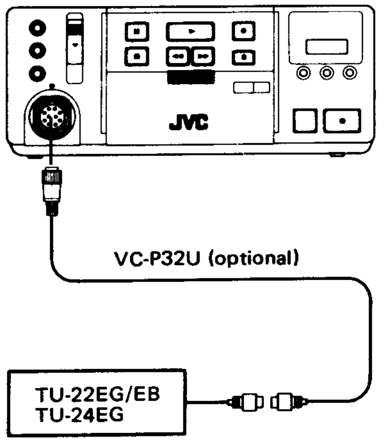


Recharging the battery pack.

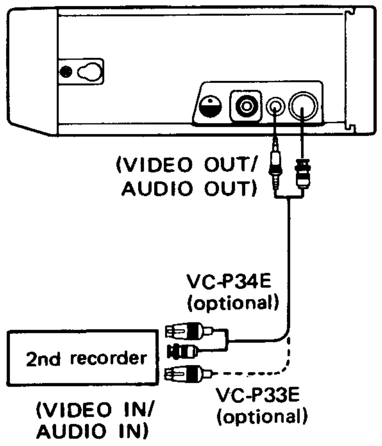

Battery charger
Battery pack

4 Recording from a tuner.

"EG" model

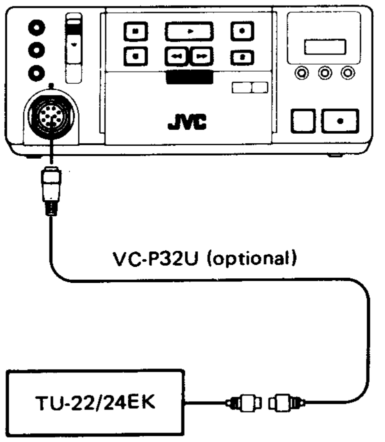

VC-P32U (optional)
TU-22EG/EB
TU-24EG

5 Tape dubbing onto another video recorder.

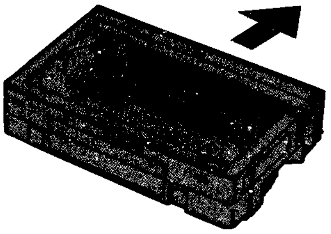

(VIDEO OUT/
AUDIO OUT)
VC-P34E
(optional)
2nd recorder
(VIDEO IN/
AUDIO IN)
VC-P33E
(optional)

4 Recording from a tuner.

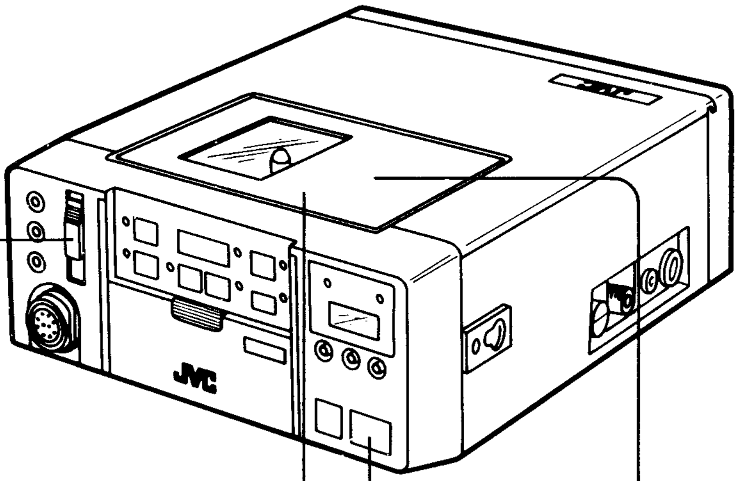
"EK" model


VC-P32U (optional)
TU-22/24EK

LOADING A VIDEO CASSETTE



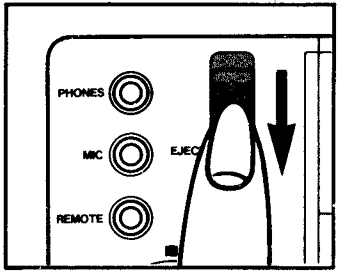
Insert the cassette with its printed arrow upward.



POWER button

If the EJECT button will not slide down, first switch on the power.

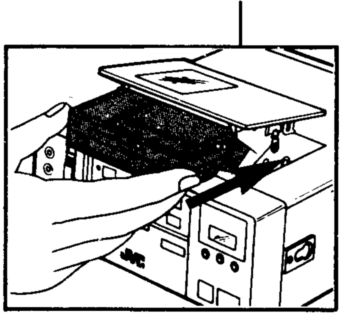
1



PHONES
MIC
EJEC
REMOTE

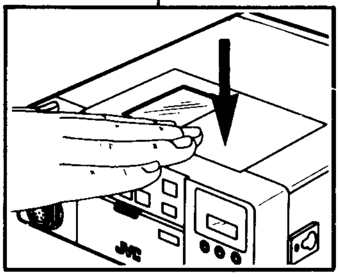
Open the cassette holder by sliding the EJECT button down.

2



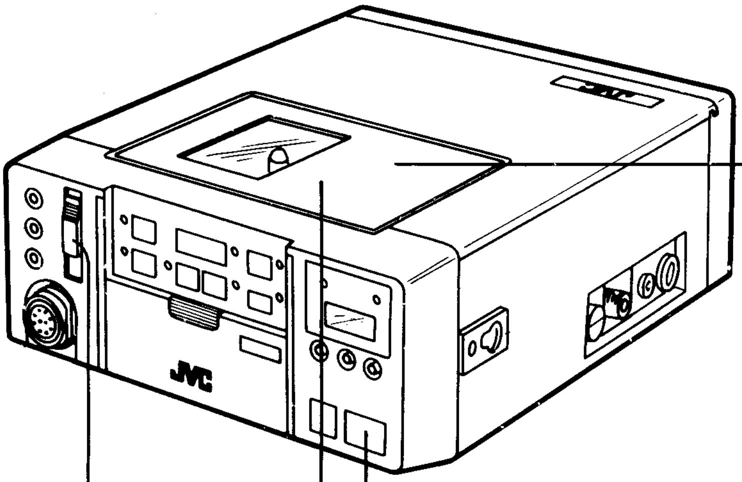
Insert the cassette.

3



Close the cassette holder.

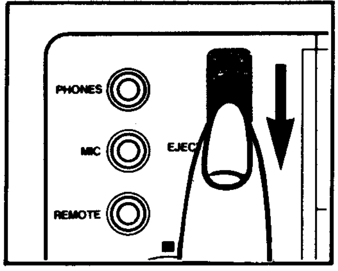
REMOVING A VIDEO CASSETTE



Make sure the recorder is in the Stop mode and the REC LOCK switch is OFF.

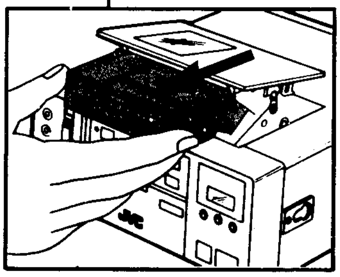
POWER button

1


PHONES
MIC
EJEC
REMOTE

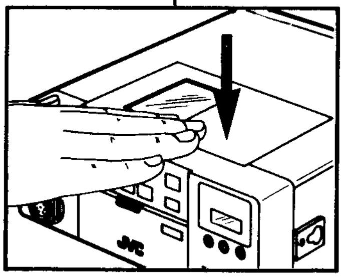
Slide the EJECT button down.

2



Remove the cassette.

3



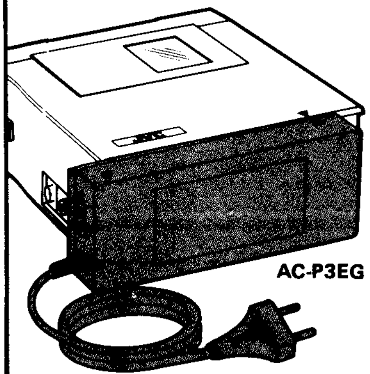
Close the cassette holder.

POWER SUPPLY SYSTEM

The convenient 3-way power supply system gives you a choice of the most appropriate power supply unit, depending on the application.

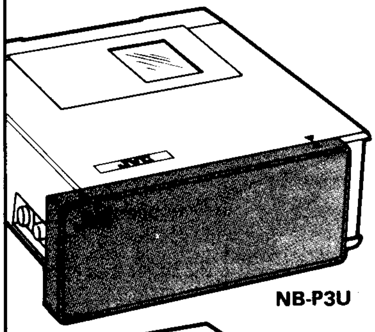
With AC power

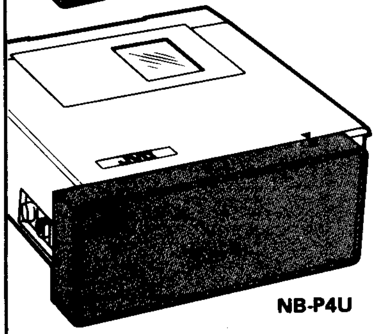
Use the optional AC-P3EG AC power pack for "EG" model, or AC-P3EK for "EK" model.


AC-P3EG
To AC outlet

Where AC power is not available

Use the NB-P3U battery pack provided or the optional NB-P4U high-capacity battery pack.

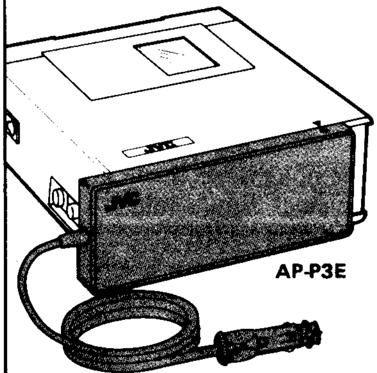




- Recharging procedure on page 13.

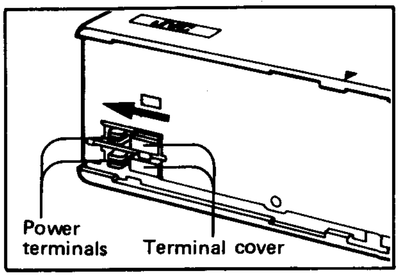
In a car

Use the optional AP-P3E car battery adapter.


AP-P3E
To car's cigarette lighter socket

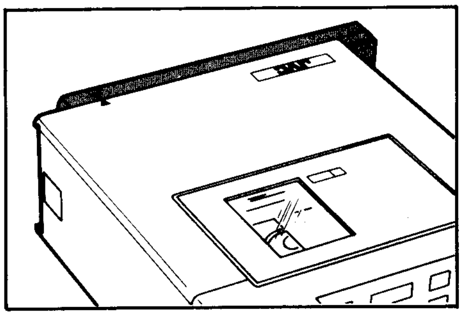
ATTACHING & REMOVING POWER SUPPLY UNITS

- The method of attachment and removal is identical for all power supply units.
- Be sure to switch off all power switches before attachment or removal.
- Check to see if the power terminals on the rear of the unit are covered with the terminal cover. If not, slide the terminal cover in the direction of the arrow.

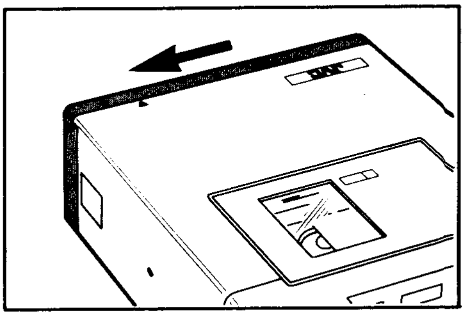


To attach

1

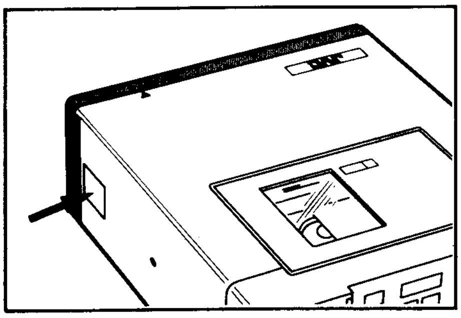

Align the marks.

2

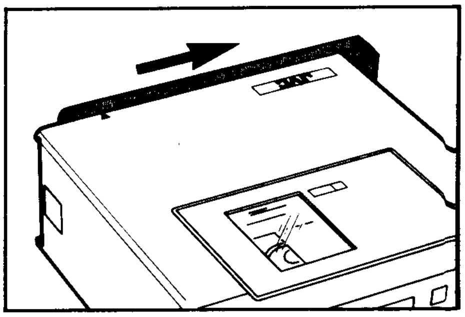

Slide until the unit locks in place.

To remove

1


While pressing the release button . . .

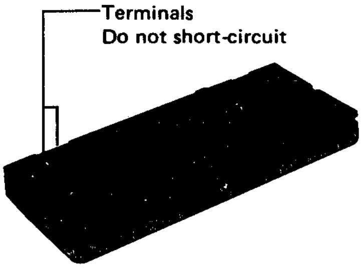
2


. . . slide off.

CHARGING THE BATTERY PACK

A WORD ON THE EXCLUSIVE NB-P3U/NB-P4U BATTERY PACKS

The NB-P3U/NB-P4U are nickel-cadmium batteries. Give attention to the following to make the most of their characteristics.



Temperature ranges:
The recharging time is based on room temperature of 20°C with a power supply of 220 V. The lower the temperature, the longer the recharging time.

For charging: 10°C to 35°C
For operating: -10°C to 40°C
For storing: -10°C to 30°C

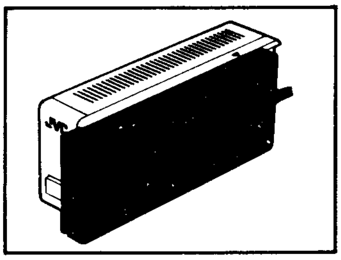
The battery pack has been kept in the uncharged state for shipment. Therefore, before use, charge it.

- **Avoid repeated charging.**
  Charging the battery pack repeatedly without using it may cause over-charging and shorten its service life.
- **Recharge using only a specified charger at 10° to 35°C.**
  Especially avoid recharging in a place under 10°C, as it may cause over-charging.
- **After use, store in a discharged condition.**
- **Do not store in places of high temperatures.**
  Choose a dry place with temperatures between -10°C and 30°C for optimum storage.
- **The battery pack becomes warm immediately after being charged. This is not due to any defect.**

Caution
The terminals are exposed on the bottom of the battery pack. DO NOT short-circuit these terminals.

- If they are shorted, a great amount of current flows. This is not only very dangerous, but also makes the battery pack unusable.
- When transporting or storing the battery pack, exercise special care so that no metallic object touches the terminals.
- Always keep the terminals clean. If they become dirty, wipe them with a piece of soft cloth.
- The fully charged NB-P3U battery pack provides power to the **HR-C3** and a video camera (whose power consumption is about 6 watts) for about 30 minutes of continuous recording; the NB-P4U, for about 50 minutes.

1



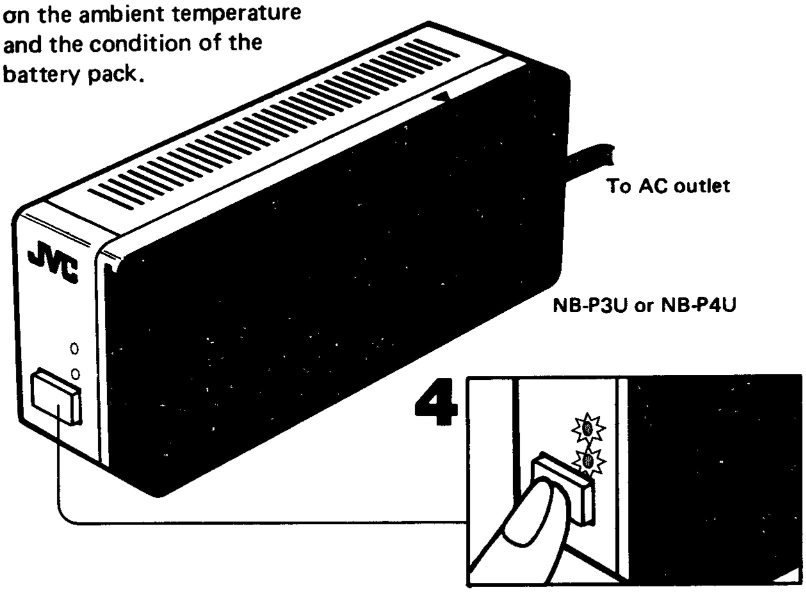
Align the marks.

Use the BB-P3EG battery charger (provided). Charging time is about 60 minutes for a regular battery pack and 90 minutes for a high-capacity battery pack.

- The charging time differs depending on the ambient temperature and the condition of the battery pack.

Note:

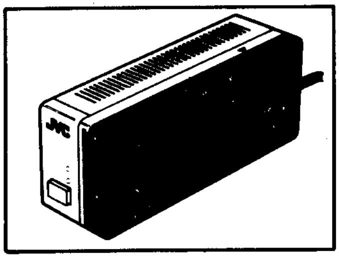
- If the terminals on the charger are exposed, attaching the battery pack is impossible. Move the cover over the terminals by hand.



4

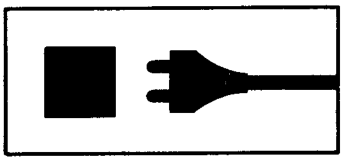
Press the POWER button. The POWER indicator will light first and the CHARGE indicator will light in a few seconds.

2



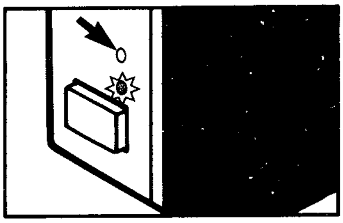
Slide until it locks in place.

3



Connect to a wall outlet.

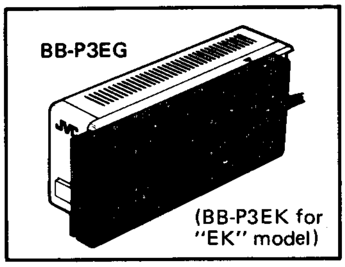
5



When charging is completed, the CHARGE indicator goes out.

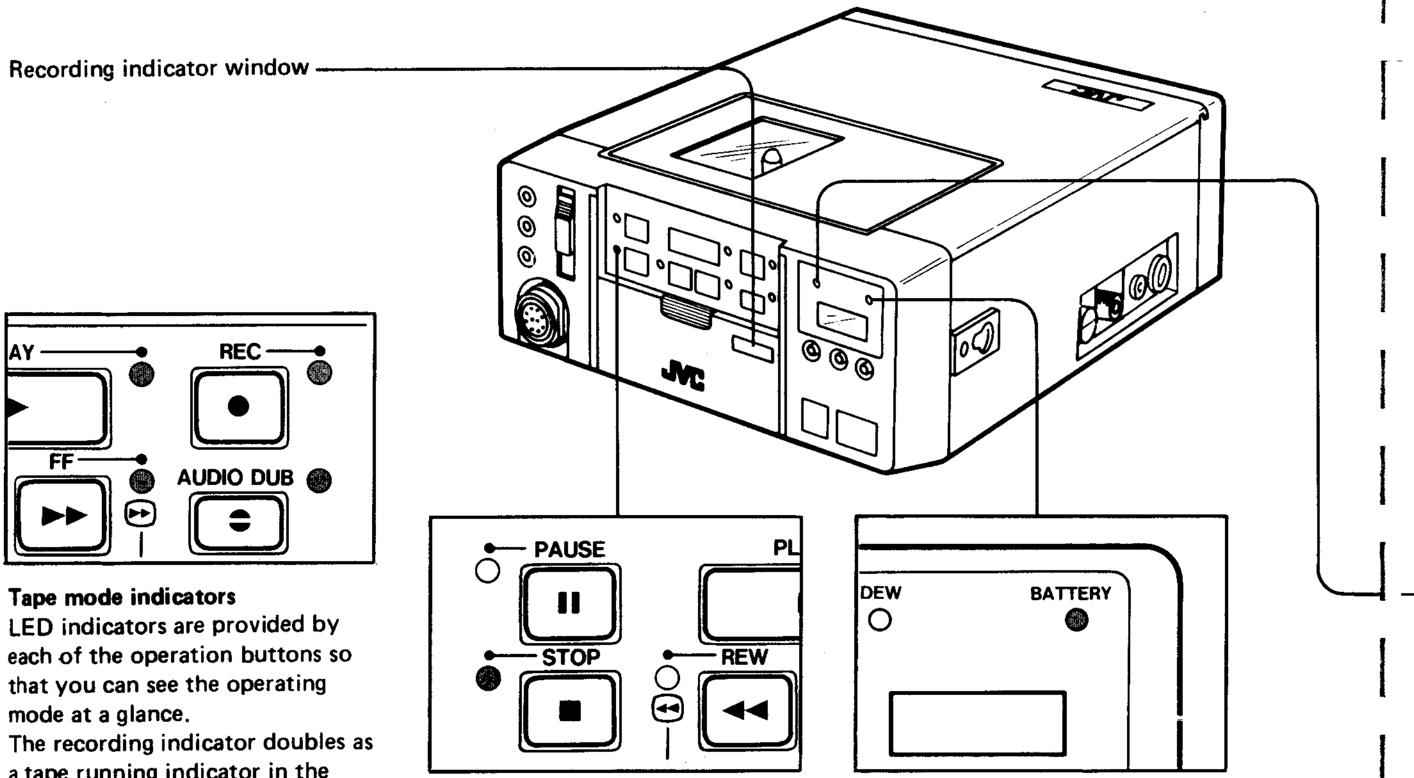
- If the POWER button is left in its ON position after the CHARGE indicator goes out, additional charging continues with a small amount of current.

6



Remove the battery pack by sliding it off.

INDICATORS



Tape mode indicators

LED indicators are provided by each of the operation buttons so that you can see the operating mode at a glance.

The recording indicator doubles as a tape running indicator in the recording mode; it lights continuously in the recording standby mode and flickers when the tape is running.

A recording indicator window is provided on the front panel slide cover for checking the recording mode with all the tape control buttons covered.

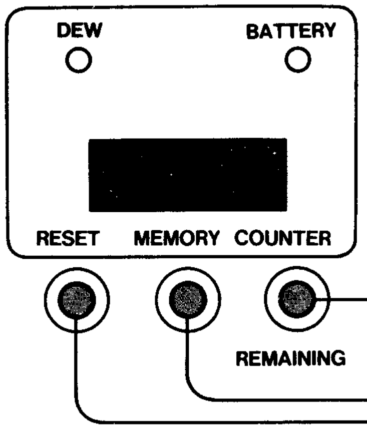
Emergency mode indicator

When the recorder fails to function properly, the STOP indicator flickers and the power will be switched off automatically after a short while. In such a case, press the POWER button to OFF and press it again to ON after a few seconds.

Battery warning indicator

This LED lights when there is insufficient battery power for normal operation, warning you that you should replace or recharge the battery pack. If you continue operating the recorder in this condition, the power will be switched off automatically.

Tape counter/Remaining time display



This is normally a 4-digit tape counter showing the amount of tape consumed. When the REMAINING button is pressed, the display shows the amount of tape left in minutes and seconds.

When power is switched off with the counter in the Remaining Time mode, the counter enters the Tape Counter mode automatically when power is switched on again.

The counter reading is held in memory for about one hour after the power is switched off; if you switch power on again within this period, the previous counter reading will be displayed.

REMAINING button

When this button is pressed, the counter enters the Remaining Time mode and displays the approximate amount of tape remaining in terms of time.

More than 5 minutes remaining: Only minutes are displayed; 7:00, 6:00, 5:00, etc.

Less than 5 minutes remaining: Minutes and seconds are displayed; 4:59, 4:58, 4:57, etc.

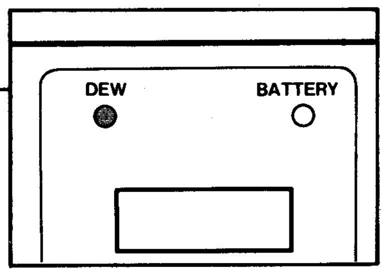
To switch to the Tape Counter mode, press this button once again.

MEMORY button

With this button pressed, the tape stops automatically when the counter reads around "0000" in the Rewind and Fast Forward modes. This is convenient when you want to locate a particular point on the tape. For more details, refer to page 25. When the MEMORY button is pressed, "M" appears in the tape counter display.

RESET button

To reset the tape counter to "0000".



Dew indicator

This LED lights when there is condensation on the head drum; when it lights, the recorder cannot be used. If this dew warning lights when you have switched on the recorder, you must turn off the unit and wait for a few hours until the indicator no longer flashes when power is applied.

Notes

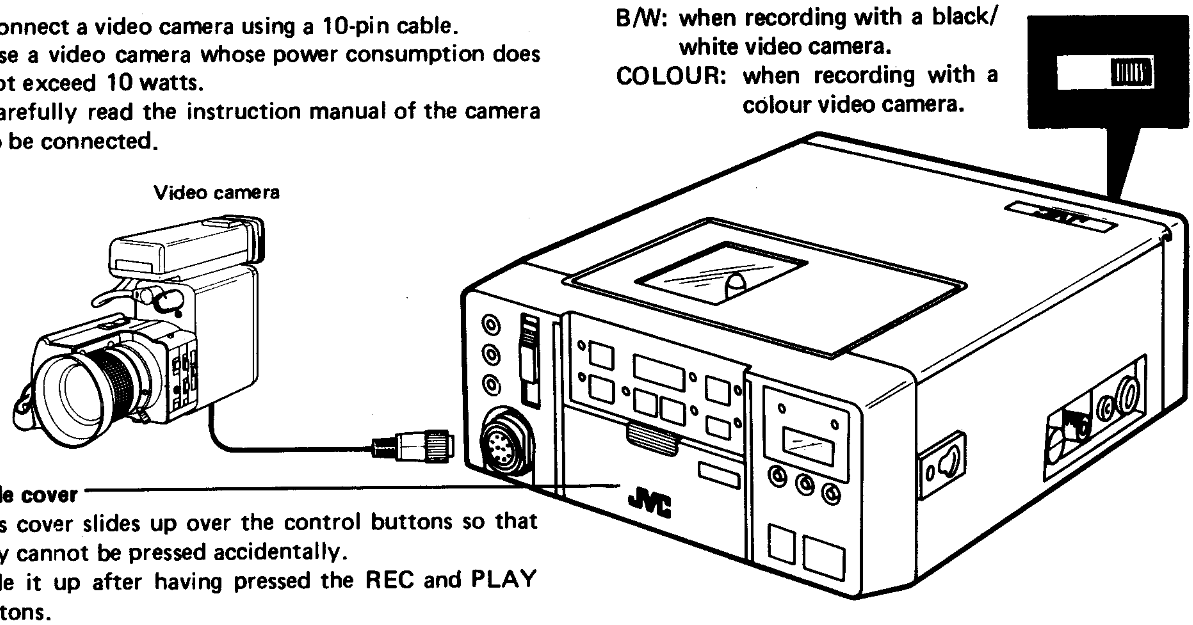
- The remaining time display does not function during fast forward or rewind.
- The remaining time indicator will present this display for about 10 seconds while it evaluates the amount of tape remaining.

RECORDING WITH A CAMERA

Connection

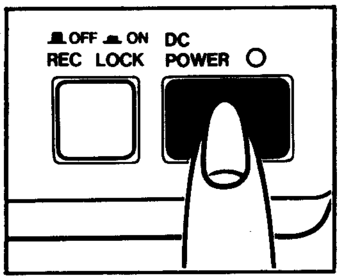
- •Connect a video camera using a 10-pin cable.
- •Use a video camera whose power consumption does not exceed 10 watts.
- •Carefully read the instruction manual of the camera to be connected.

Before attaching the power supply unit, set the video mode select switch as required:
B/W: when recording with a black/white video camera.
COLOUR: when recording with a colour video camera.



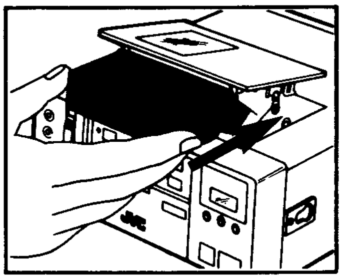
Slide cover
This cover slides up over the control buttons so that they cannot be pressed accidentally.
Slide it up after having pressed the REC and PLAY buttons.

1



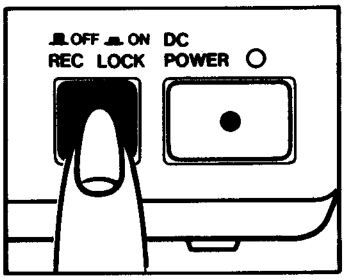
Press the POWER button to ON.

2



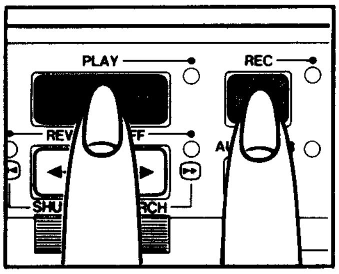
Insert a video cassette.

3



Press the REC LOCK button to ON. (For the function of this button refer to page 19.)

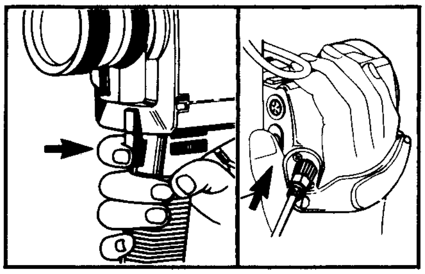
4



Press the REC and PLAY buttons simultaneously.

- Make sure that the camera's start/stop switch is in its "stop" position.

5



When you are ready to start recording, press the camera's start/stop switch.

- To temporarily stop recording, simply press the camera's start/stop switch. If this standby mode continues for longer than 5 minutes, power is automatically shut off. To continue shooting, press the POWER button to ON and operate the camera's start/stop switch.

To end recording

Press the STOP button. Then press the REC LOCK and POWER buttons to OFF in that order.

AUTOMATIC BACKSPACE EDITING & RECORDING STANDBY LOCK

The REC LOCK switch is to avoid unnecessary power consumption while in the Recording Standby mode and keeps the tape loaded so that the automatic backspace editing functions to make clean assembled edits when recording is resumed.

A

During playback | PAUSE → POWER OFF → STOP (The tape is unloaded.)

B

During recording | PAUSE* → POWER OFF → STOP (The tape is unloaded.)

C

During recording | PAUSE* → REC LOCK ON → POWER OFF → PAUSE (Standby) (The tape remains loaded and, when power is reapplied, recording starts automatically.)

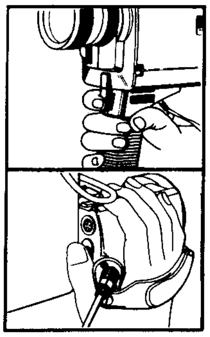
* Entering the Pause mode during recording, the tape rewinds (backspaces) automatically for about 1 second. The automatic Quick Review function allows you to view the playback picture during this 1-second backspacing period for a convenient check of your recording.

Notes

- ●Playback cannot be started when the REC LOCK button is ON.
- ●The EJECT button does not function when the REC LOCK button is ON.

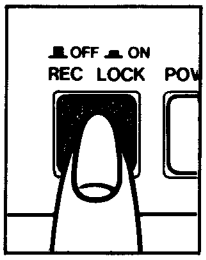
Use the REC LOCK button effectively during camera recording.

1



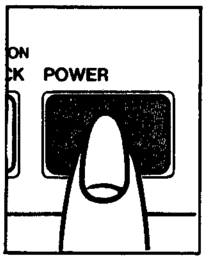
Stop the camera.
(The recorder enters the Pause mode.)

2



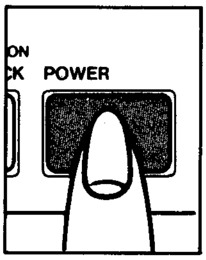
Press the REC LOCK button to ON.

3



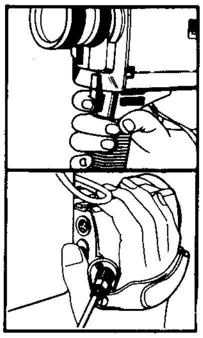
Switch off the power.
(Take time to prepare for the next shot.)

4



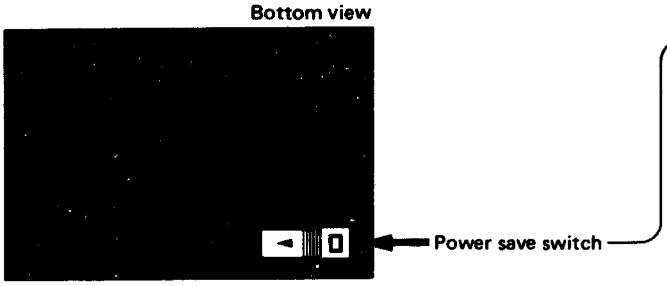
Switch on the power.

5



Start the camera after about 10 seconds.

POWER SAVE FUNCTION

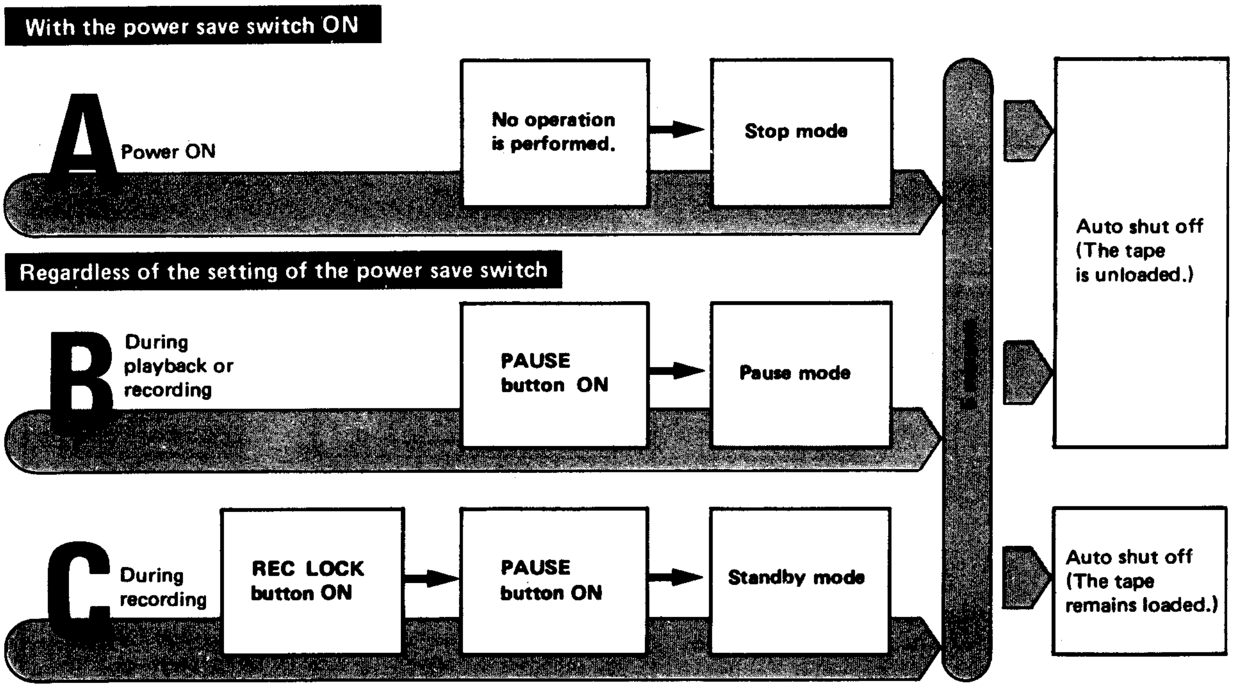

Bottom view
Power save switch

In its ON position, this switch saves power by automatically switching off power if the unit remains in the Stop mode for more than 5 minutes.

Prior to shipment, this switch has been set to ON. If inconvenience results from this condition, reset the switch.

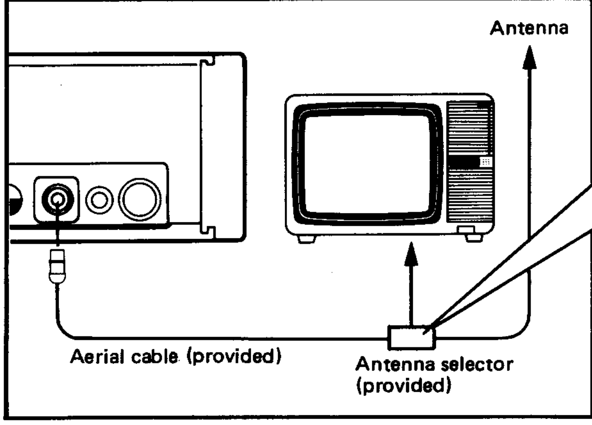
Slide the cover to the left.

Reset the switch to the right with a small screwdriver.

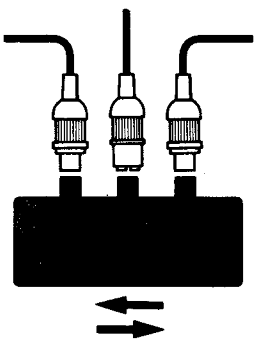

With the power save switch ON
A Power ON
No operation is performed.
Stop mode
Regardless of the setting of the power save switch
B During playback or recording
PAUSE button ON
Pause mode
C During recording
REC LOCK button ON
PAUSE button ON
Standby mode
Auto shut off (The tape is unloaded.)
Auto shut off (The tape remains loaded.)

PLAYBACK

Connection

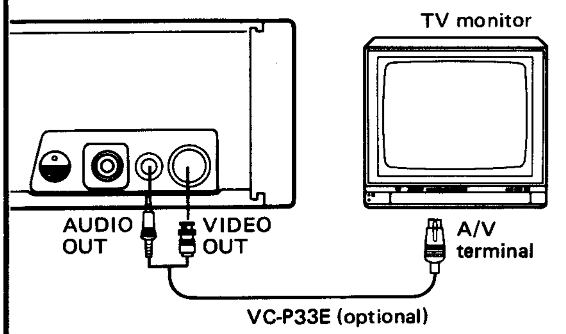

Antenna
Aerial cable (provided)
Antenna selector
(provided)

How the antenna selector works

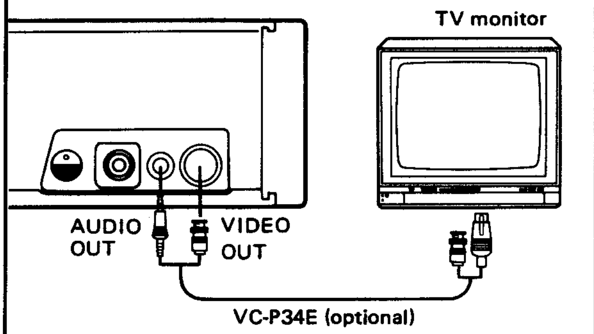


- Switch the antenna selector to "ANT" to view a broadcast TV programme.
- Switch the antenna selector to "VTR" to view a video tape. When checking what has just been recorded, also switch to "VTR". Then, turn the TV channel to your video channel.

This connection lets you view both TV broadcasts and video tapes with a single TV receiver.


TV monitor
AUDIO
OUT
VIDEO
OUT
A/V
terminal
VC-P33E (optional)

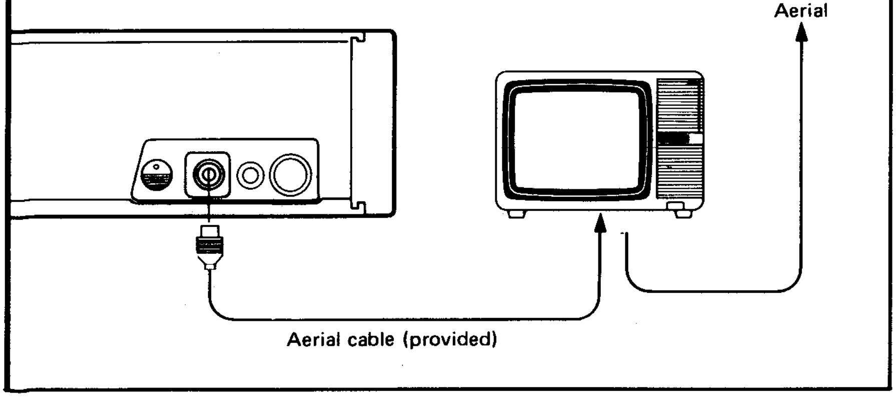
If your TV set is equipped with an A/V connector, use the VC-P33E optional A/V cable to connect the **HR-C3** to your TV set for playback.


TV monitor
AUDIO
OUT
VIDEO
OUT
VC-P34E (optional)

If your TV set is equipped with audio and video input connectors, use the VC-P34E optional A/V cable to connect the **HR-C3** to your TV set for playback.

"EK" model

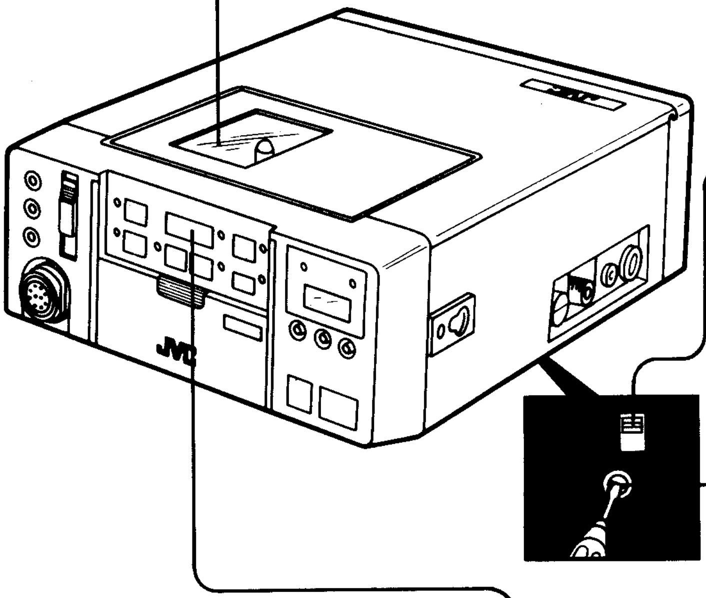
Using a TV receiver


Aerial
Aerial cable (provided)

Operation

Insert a prerecorded cassette.

Note:
- Playback cannot be started when the REC LOCK button is ON.



When you use a TV receiver built to the British PAL standard, shift the system select switch to I.

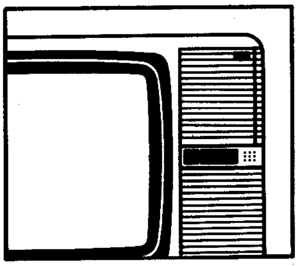
RF CONVERTER ADJUSTMENT

The HR-C3 incorporates an RF converter for playback using a TV receiver. The output of the RF converter can be seen on the TV screen on a vacant channel which is not used for public broadcasting. The RF converter in this unit has been set to UHF channel 36 before shipment. If channel 36 is employed for broadcasting in your area, reset the RF converter channel to one of the vacant channels between 32 and 40 as follows:

1. Adjust the TV receiver channel to one of the vacant channels.
2. Connect a video camera and switch the power on for the recorder.
3. While monitoring the camera signal on the TV screen, turn the RF converter channel adjustment screw in either direction so that the monitored picture comes in most clearly.

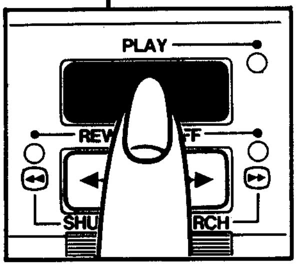
- When you wish to view video cassette programmes, always set the TV receiver's channel selector to your VIDEO CHANNEL.

1



Set your TV to your video channel.

2

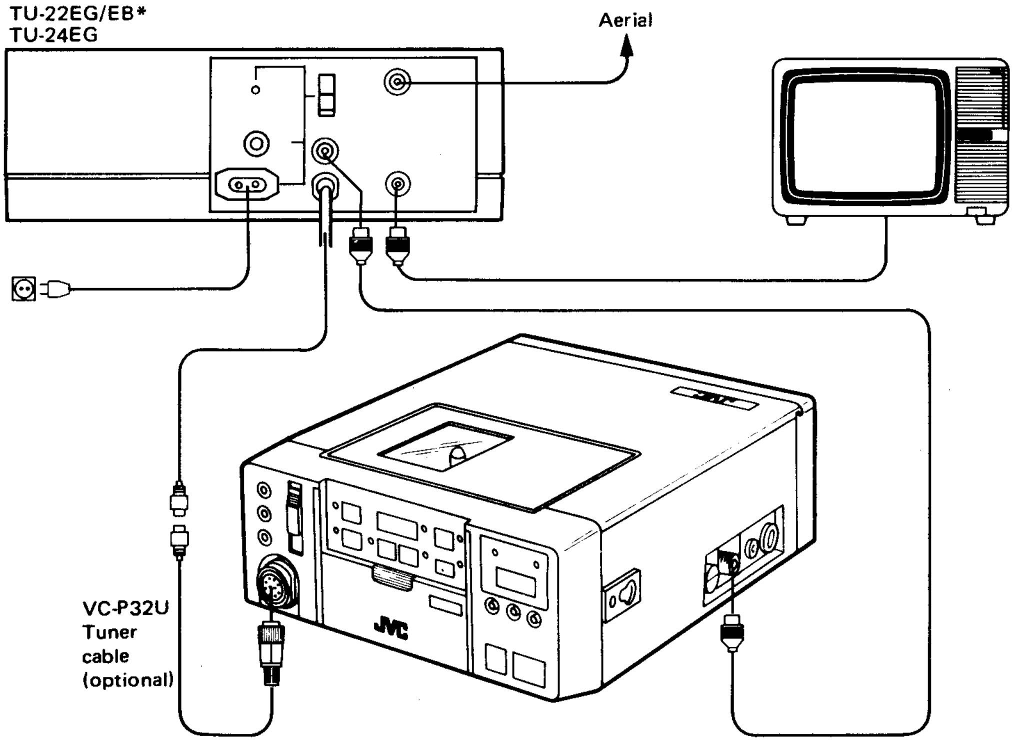


Press the PLAY button.

RECORDING TELEVISION PROGRAMMES

Connection

- Use the TU-22EG/EB or TU-24EG* tuner and connect its output cord to the CAMERA connector of the HR-C3 using the optional VC-P32U tuner cable.


TU-22EG/EB*
TU-24EG
Aerial
VC-P32U
Tuner
cable
(optional)
JVC

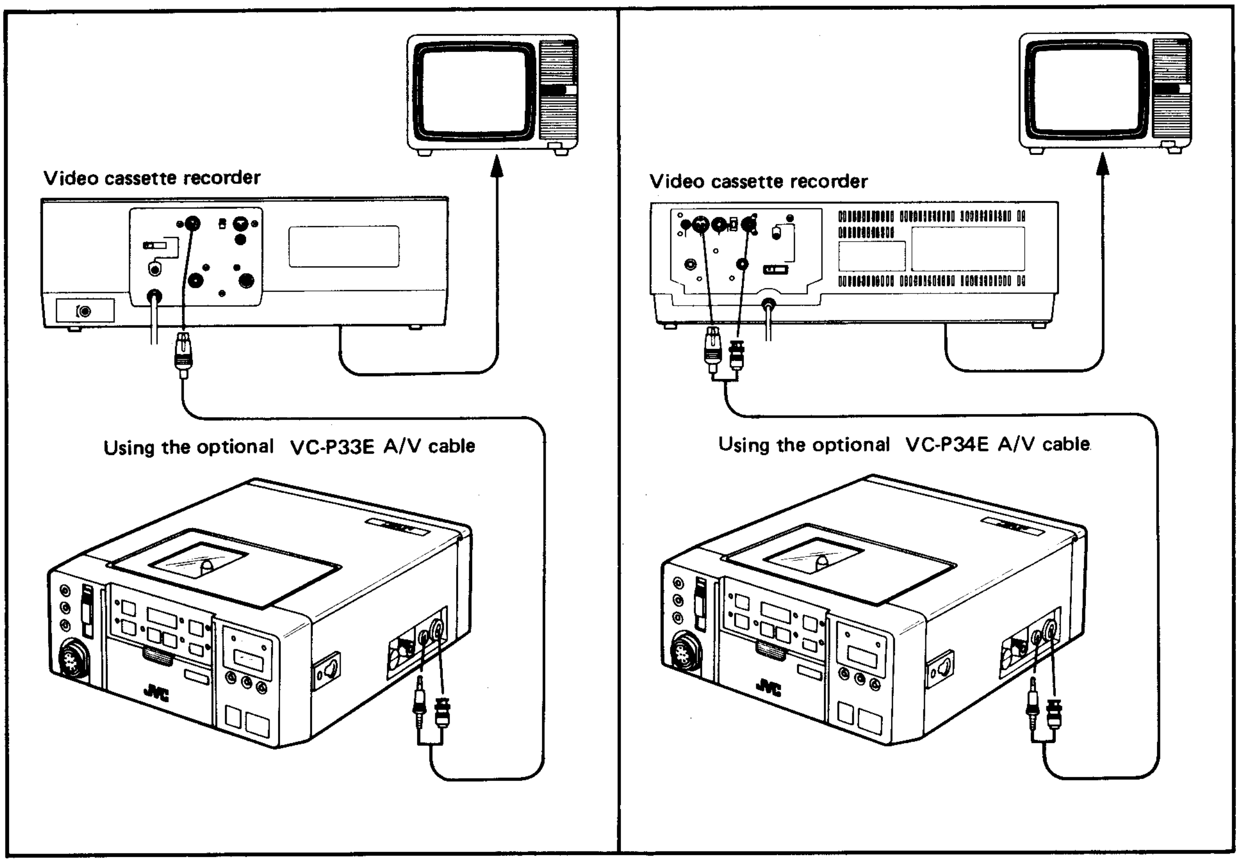
*for "EK" model use TU-22EK or TU-24EK

Select the programme with the channel selector of the tuner and press the REC and PLAY buttons simultaneously.

- Recording one programme while watching another is possible. Refer to the instruction manual for the *TU-22EG/EB or TU-24EG.
- Timer recording is not possible using the HR-C3.

TAPE-TO-TAPE DUBBING

Dubbing onto another video recorder


Video cassette recorder
Using the optional VC-P33E A/V cable
Video cassette recorder
Using the optional VC-P34E A/V cable

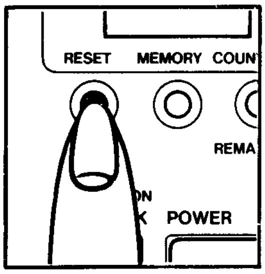
Play back the tape to be dubbed with the **HR-C3** and put the 2nd video recorder in the Record mode.

OTHER CONVENIENT FEATURES

Memory counter

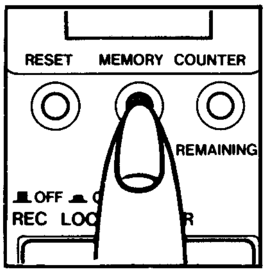
This lets you accurately and quickly locate and play back any required section of the tape.

1


RESET
MEMORY COUN
REMA
N
K
POWER

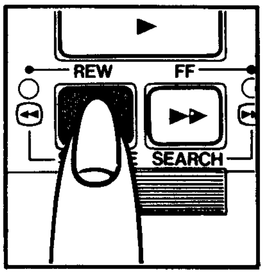
During playback or recording, press the RESET button at the beginning of the section you want to play back.

2


RESET
MEMORY COUNTER
REMAINING
OFF
REC LO
R

At the end of recording or after playing back the required section, press the MEMORY button; M now appears in the display.

3


REW
FF
SEARCH

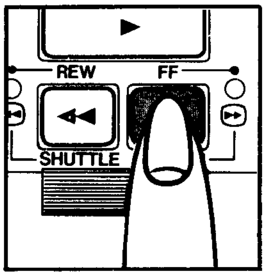
Press the rewind button the tape will rewind to the position where the counter reading is "0000" and then rewinding will stop.

Shuttle Search

This lets you fast forward and rewind the tape at 3 times normal speed while watching the speeded up picture, to quickly check the content of any section.

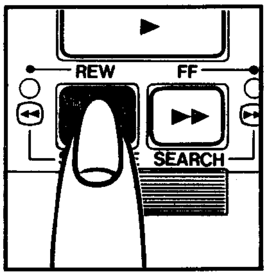
Start playback.

1


REW
FF
SHUTTLE

To shuttle search forward, continue pressing the FF (►►) button while in the Play mode.

2

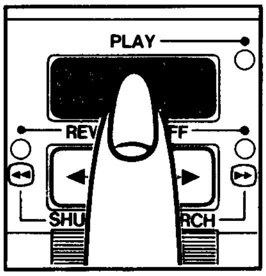

REW
FF
SEARCH

To shuttle search in the reverse direction, continue pressing the REW (◄◄) button while in the Play mode.

Release your finger; normal playback will resume.

Noise bars in the picture during shuttle search are inevitable.

4



Now press the PLAY button. The required section will be played back.

- The memory counter functions in the fast forward mode as well.

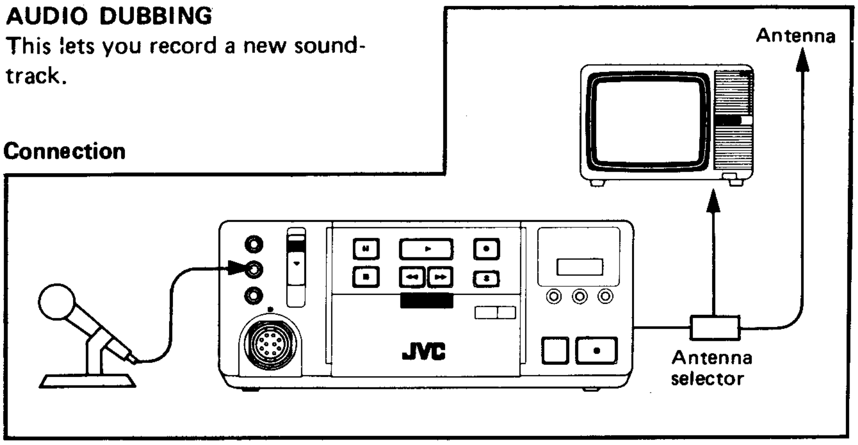
Tracking control

If the playback picture contains noise bars, turn the TRACKING control knob to centre. If noise bars still appear, turn the knob slowly in either direction until they move out of the screen. Recording should always be done with this control returned to centre.

AUDIO DUBBING

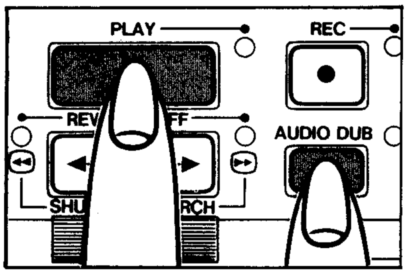
This lets you record a new soundtrack.

Connection



Operation

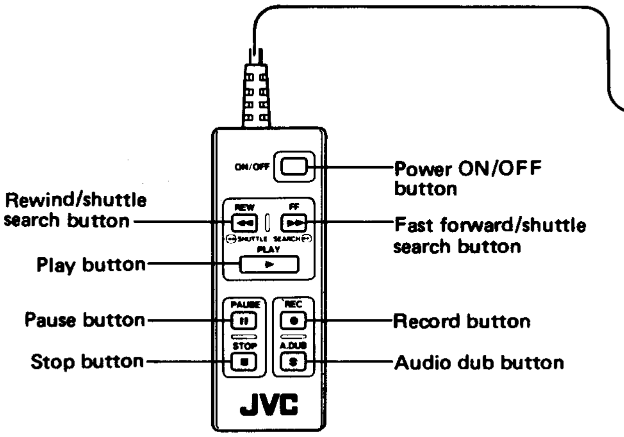
- Load the cassette on which you want to record a new soundtrack.
- Set the TV to the video channel.
- Switch on the power.
- Press the PLAY and AUDIO DUB buttons together.
- Now, while watching the video part of the programme on the TV, you can add the narration by speaking into the microphone.
- To stop audio dubbing, press the STOP button.

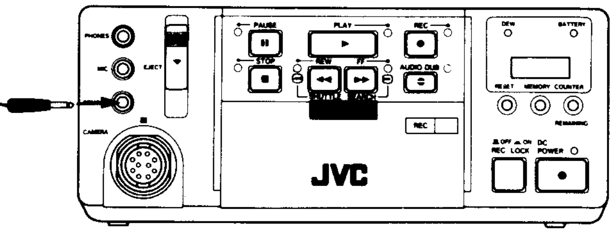


Notes:

- The previously recorded sound is erased and replaced with a new soundtrack by audio dubbing.
- The pause function facilitates audio dubbing. First play back the prerecorded tape and press the PAUSE button at the point from which you wish to start audio dubbing. Then press the AUDIO DUB and PLAY buttons simultaneously. This permits you to start audio dubbing exactly at the right point.

REMOTE CONTROL


ON/OFF
Power ON/OFF button
Rewind/shuttle search button
REW
FF
SHUTTLE SEARCH
Fast forward/shuttle search button
PLAY
Play button
PAUSE
REC
Pause button
Record button
STOP
A.DUB
Stop button
Audio dub button
JVC

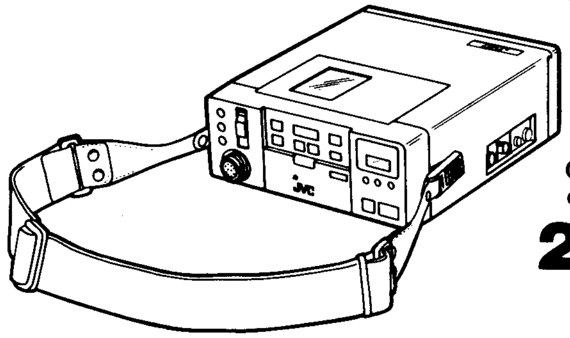

PHONES
MIC
EJECT
CAMERA
PAUSE
PLAY
REC
STOP
REW
FF
AUDIO DUB
DEW
BATTERY
RESET
MEMORY COUNTER
REMAINING
REC LOCK
POWER
JVC

Connect the remote control unit to the REMOTE terminal.

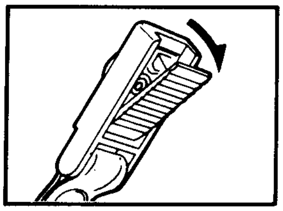
Note:

- Avoid pressing two or more buttons simultaneously (except PLAY and REC or PLAY and AUDIO DUB), otherwise malfunctioning may result.

ATTACHING THE SHOULDER STRAP

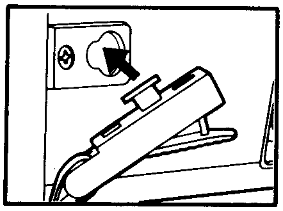


1



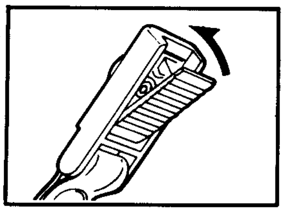
Open the lock caps on both ends of the shoulder strap.

2



Insert the lugs into the holes.

3

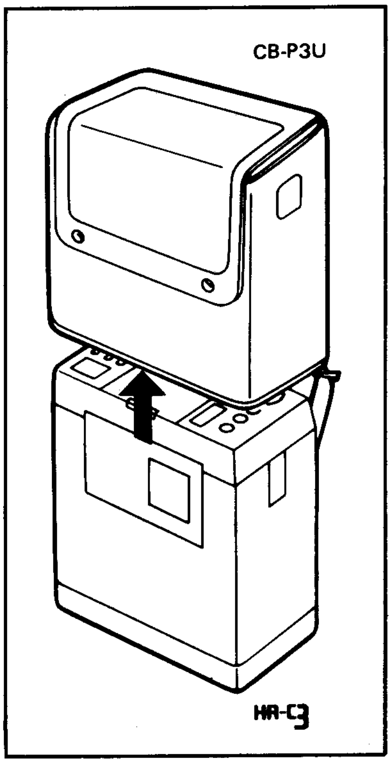


Close the lock caps.

To remove the shoulder strap, first open the lock caps.

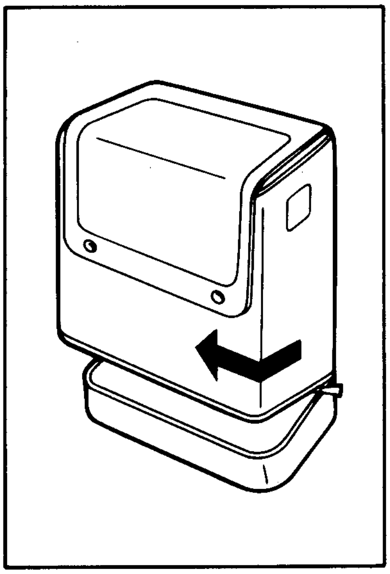
CARRYING CASE

1



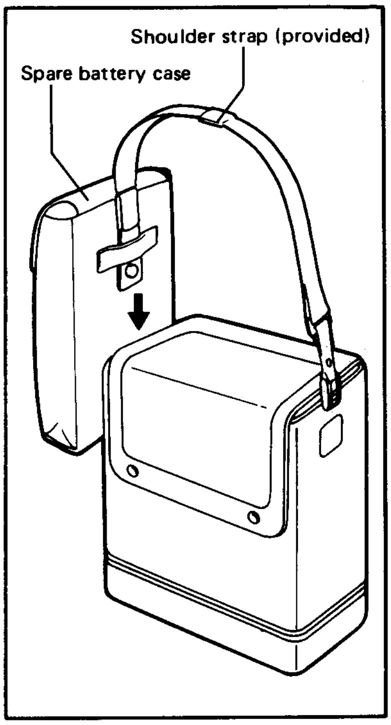
Open the bottom cover and insert the HR-C3 from below as illustrated.

2



When the NB-P4U high-capacity battery pack is attached to the HR-C3 remove the sponge block. With the NB-P3U regular battery pack, leave the sponge block inside the bottom cover. Zip the cover closed.

3



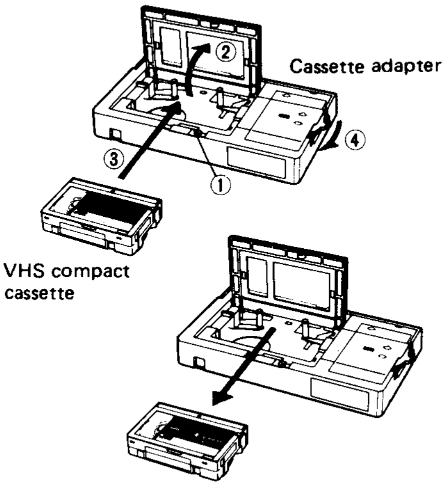
Attach the shoulder strap.

CAUTION

The carrying case is equipped with a belt loop. However, avoid carrying the recorder by attaching it only to your belt. This belt loop is to further stabilize the recorder and hold it next to your body when you are carrying it with the shoulder strap.

CASSETTE ADAPTER C-P2U (Optional)

The VHS compact video cassette can be played back (or even recorded) with a standard VHS machine by using the optionally available cassette adapter.



Inserting a compact video cassette

1. Push the sliding latch in the direction of the arrow.
2. Open the compartment door.
3. Insert the compact video cassette into the adapter and close the compartment door.
4. Turn the loading gear in the direction of the blue LOADING arrow until the indicator window is completely blue.

Removing the compact video cassette

1. Turn the loading gear in the direction of the red UNLOADING arrow until the indicator window is completely red.
2. Push the sliding latch in the direction of the arrow to open the compartment door.
3. Using the smaller hole on the underside of the adapter, push the cassette up from below and remove it.
4. Close the compartment door.
5. Put the compact cassette in its case for storage.

- For more detail refer to the instruction manual for the C-P2U.

IN CASE OF DIFFICULTY

Symptoms	Check points
No power.	• Is the battery pack correctly installed? • Is the battery pack charged? • Is the POWER switch of the connected AC power pack set to ON? • Is the car battery adapter correctly plugged in?
Playback is impossible.	• Is the REC LOCK button ON? Press it to OFF.
Recording or audio dubbing is impossible.	• Check to see if the cassette safety tab is in place. Refer to page 4.
Tape stops during fast forward or rewind.	• Is the "M" indication visible in the tape counter? If so, press the MEMORY button to cancel the memory function.
Rewinding or fast forwarding is impossible.	• Check to see if the tape has already been fully wound to one reel or the other.
Tape is running, but no playback picture.	• Is the TV receiver set to your video channel? • If a TV monitor is used, is its TV/VIDEO switch set to VIDEO?
Noise bars appear in the playback picture.	• Use the TRACKING control to remove noise bars. Refer to page 26.
Playback picture is blurred or interrupted while TV programs received are clear.	• Video heads may be dirty or worn out. For head cleaning or replacement, consult the nearest JVC dealer.

HR-C3EG SPECIFICATIONS

Format	: VHS standard
Video signal system	: PAL-type colour and CCIR monochrome signals, 625 lines
Video recording system	: Luminance: FM recording Colour: Phase shift & converted subcarrier direct recording Rotary, slant azimuth, two-head helical scan system
Tape width	: 12.65 mm
Tape speed	: 23.39 mm/sec
Playing time	: 30 minutes with EC-30 compact video cassette
Rewind time	: Approx. 1 minute with EC-30 video cassette
Fast forward time	: Approx. 2 minutes with EC-30 video cassette
Shuttle search speed	: Approx. 3 times normal speed
Video	
Input	: 0.5 to 2.0 Vp-p, 75 ohms
Output	: 1.0 Vp-p, 75 ohms
S/N ratio	: 43 dB (with Rohde & Schwarz noise meter)
Picture resolution	: 250 lines
Audio	
Mic input	: -67 dBs, high impedance, unbalanced
Line output	: -6 dBs, less than 1 k-ohm, unbalanced
Frequency range	: 70 Hz to 10 kHz
S/N ratio	: 40 dB
RF converter	
VHF output channel	: UHF 32 – 40 (adjustable)
Channel setting	: Set to UHF 36 prior to shipment
Power requirement	: 12 V DC⎓
Power consumption	: 6 watts (16 watts with camera) (4.9 watts, nominal in the record mode)
Weight	: 2.0 kg 2.4 kg including battery pack
Dimensions	: 182(W) x 75.5(H) x 203(D) mm Depth extended to 215 mm with the NB-P3U attached
Temperature	: Operating: 0°C to 40°C Storage: -20°C to 60°C

Provided accessories

- Remote control unit RM-P3U
- Regular battery pack (0.7 AH) NB-P3U
- Battery charger BB-P3EG (BB-P3EK for "EK" model)
- Carrying case CB-P3U
- Antenna selector (not provided with "EK" model)
- Shoulder strap
- Aerial cable x 2 (1 cable with "EK" model)
- Video cassette (EC-30)

Optional accessories

- Regular battery pack (0.7 AH) NB-P3U
- High-capacity battery pack (1.2 AH) NB-P4U
- Battery charger BB-P3EG (BB-P3EK for "EK" model)
- AC power pack AC-P3EG (BB-P3EK for "EK" model)
- Car battery adapter AP-P3E
- Cassette adapter C-P2U
- Tuner cable VC-P32U
- A/V cable VC-P33E
- A/V cable VC-P34E
- Video cassette (EC-30)

Design and specifications subject to change without notice.

SECTION 1
GENERAL DESCRIPTION

1.1 VHS-C CASSETTE CONFIGURATION

The VHS-C system employs a smaller size cassette than the VHS system, while maintaining signal and electrical compatibility with the VHS format. Although less than 1/3rd the size of a VHS cassette, the VHS-C cassette can be used in a full size VHS machine by utilizing a special adapter.

Fig. 1-1 illustrates the VHS-C cassette. As can be noted, although the supply reel is conventional, the take-up reel is gear driven. Consequently, the VHS-C recorder possesses only a supply reel disk, while a take-up reel disk is absent.

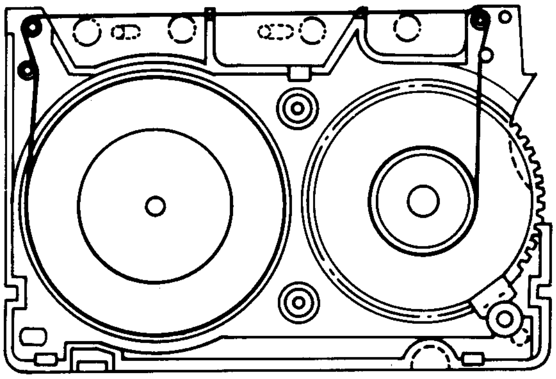


Fig. 1-1 VHS-C cassette

When installed in the cassette adapter, the internal poles of the adapter position the tape in the same configuration as a conventional VHS cassette. This is indicated in Fig. 1-2.

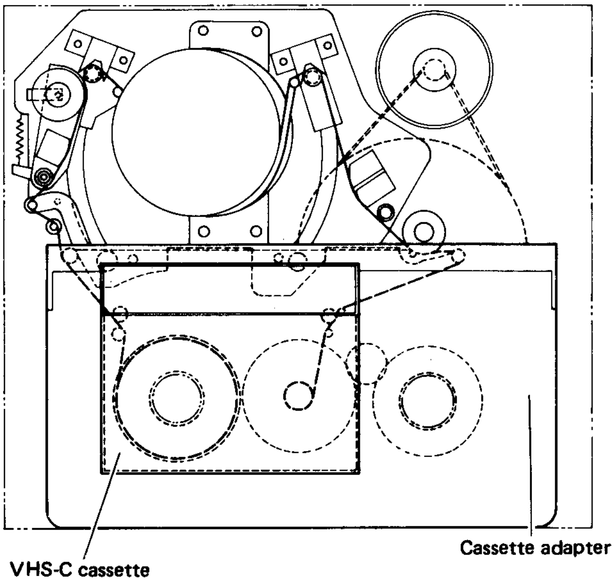


Fig. 1-2 Cassette adapter

At this time, the supply reel of the VHS-C cassette becomes driven by the supply reel disk of the VHS recorder. For driving the take-up reel, rotation of the take-up reel disk is transferred by a pulley and gear. Fig. 1-3 shows this system.

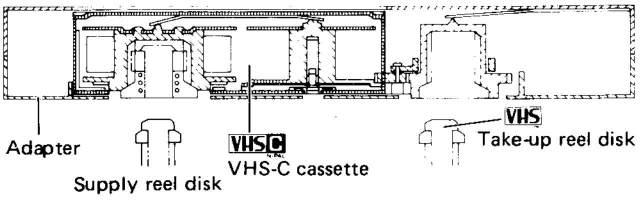


Fig. 1-3 Adapter reel drive method

1.2 VHS-C CASSETTE OUTLINE

JVC Version : Type EC-30, 30 minutes
VHS-C logo displayed prominently on cassette and package

1. Video Tape

   Tape Length : 43.7^{+2}_{-0} meters

   Tape Thickness : 19^{+1}_{-2} μm

   Other video tape specifications are the same as those for the VHS format.

2. Leader and Trailer Tape

   Leader Tape Length : 80 ± 5 mm

   Trailer Tape Length : 110 ± 5 mm

   Leader & Trailer
   Tape Thickness : 20^{+2}_{-6} μm

   Leader & Trailer
   Tape Transparency: Greater than 70 %

   Other leader and trailer tape specifications are the same as those for the VHS format.

3. Dimensions & Appearance: See Fig. 1-4.

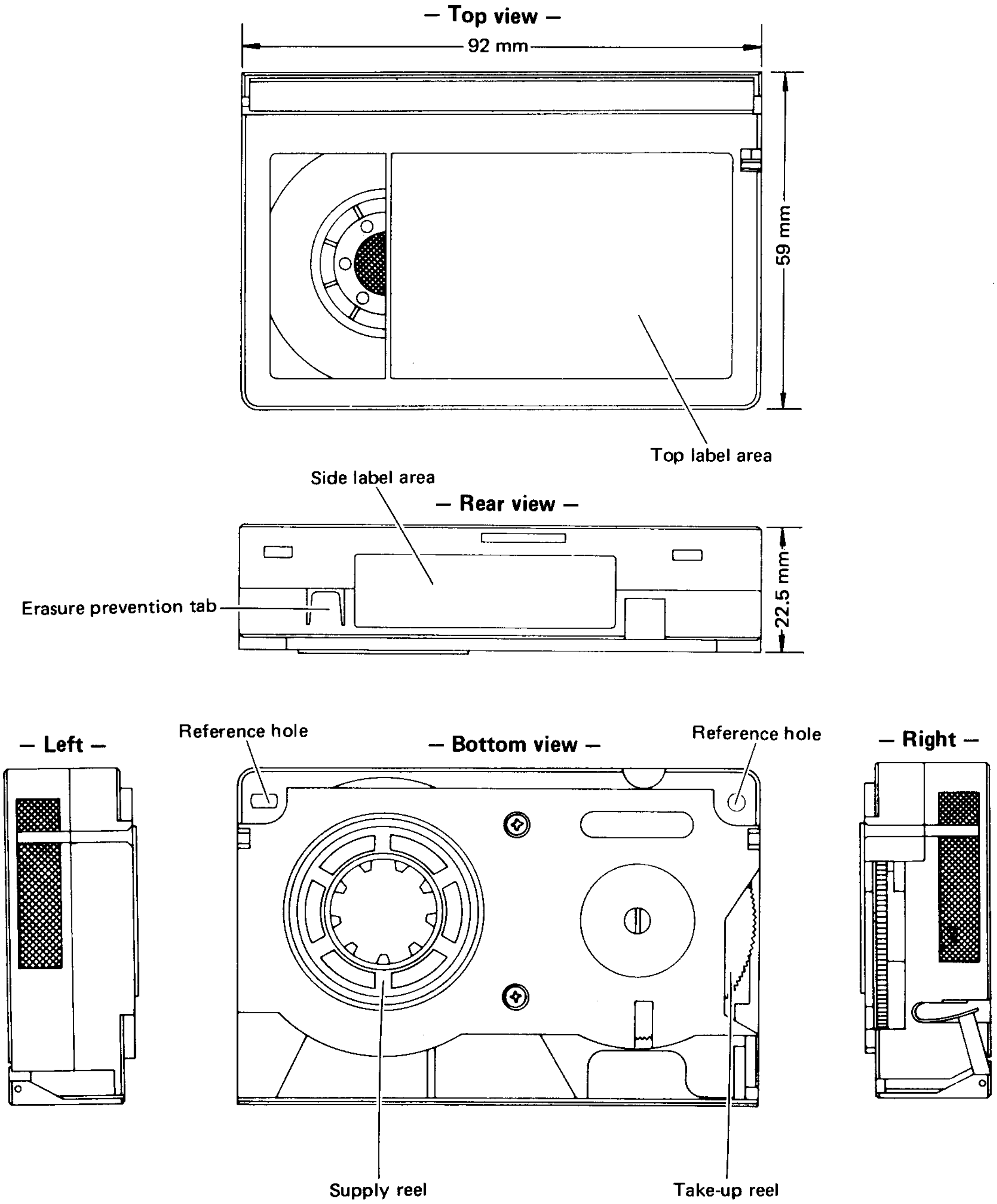

– Top view –
92 mm
59 mm
Top label area
Side label area
– Rear view –
Erasure prevention tab
22.5 mm
– Left –
Reference hole
– Bottom view –
Reference hole
– Right –
Supply reel
Take-up reel

Fig. 1-4 Dimensions & Appearance

1.3 HR-C3 FEATURES

1. Compact, lightweight, low power consumption

Mainframe weight	: 2 kg
Power consumption	: 8 watts (18 watts with camera) (4.8 watts, nominal in the recording mode) 30 minutes operation with NB-P3; 50 minutes with NB-P4

2. AEF (Automatic Editing Function) system
   This unit incorporates a back-space editing system with back-review function. When the PAUSE button is pressed during recording, a one second segment of the tape becomes rewound, then the Pause stand-by mode is entered. Pressing the PLAY button at this time yields playback for 0.9 sec, then recording becomes resumed with 0.1 sec overlap.

3. Power save circuit
   With the POWER SAVE switch on, the unit will automatically switch off power if the Stop mode continues for more than 5 minutes. This feature aids in reducing power consumption during battery operation.

   The power save circuit also functions during operation from other than battery power, such as using the AC adapter.

4. Battery warning system
During battery operation, when the voltage declines below 11.0 V, the BATTERY LED begins flashing. At less than 10.3 V, the unit automatically enters the Stop mode and power is switched off. This aids in avoiding problems due to excess battery drainage.

5. Remote control capability
The remote control unit allows operation of all main functions, including power on/off from a distance.

6. Shuttle search functions
Shuttle Search in both FF and REW directions can be performed at three times normal playback speed.

7. Tape counter
The liquid crystal display (LCD) tape counter also provides indication of tape remaining time. Remaining time is displayed in minutes from 23:00 to 5:00, and in seconds from 4:59 to 0:00.

- Power on/off control
Power on/off can be controlled from the front panel POWER switch, the power switch of the remote control unit, and from the camera remote power switch (provided that the employed camera is equipped with this feature).

- Recording lock system
This functions only in the Recording mode. Note that the Play mode cannot be entered if the REC LOCK button is depressed to the on position.

  During recording with the REC LOCK button depressed, if the power is switched off, a one second segment of the tape becomes rewound automatically, then the pinch roller disengages from the capstan and the power is cutoff. When power is returned, the pinch roller re-engages and after 2 to 3 seconds, the servos lock to enable recording. This becomes the Recording-Pause mode. At the recording start command, the tape is played back for 0.9 sec, then recording resumes with 0.1 sec (approx. 3 frames) overlap.

- Switching regulator circuit
The switching regulator circuit supplies power in five lines (regulated 5 V and 9 V, and power for the reel, capstan and drum motors) in order to minimize circuit power consumption.

- Tape sensor
A cassette lamp is not employed due to space considerations. The reel pulse is detected during the Fast Forward and Rewind modes. In the Play and Search-FF modes, tape end is detected by an LED and photo transistor, which activate the auto stop function.

- Capstan motor
A recently developed brushless direct drive (DD) motor is used for the capstan. The motor drive amplifier (MDA) IC is incorporated in the capstan DD motor assembly.

- Drum motor
This is a newly designed slim type brushless DD motor.

SECTION 2
MECHANISM DESCRIPTION

2.1 FUNCTION OF MAIN PARTS

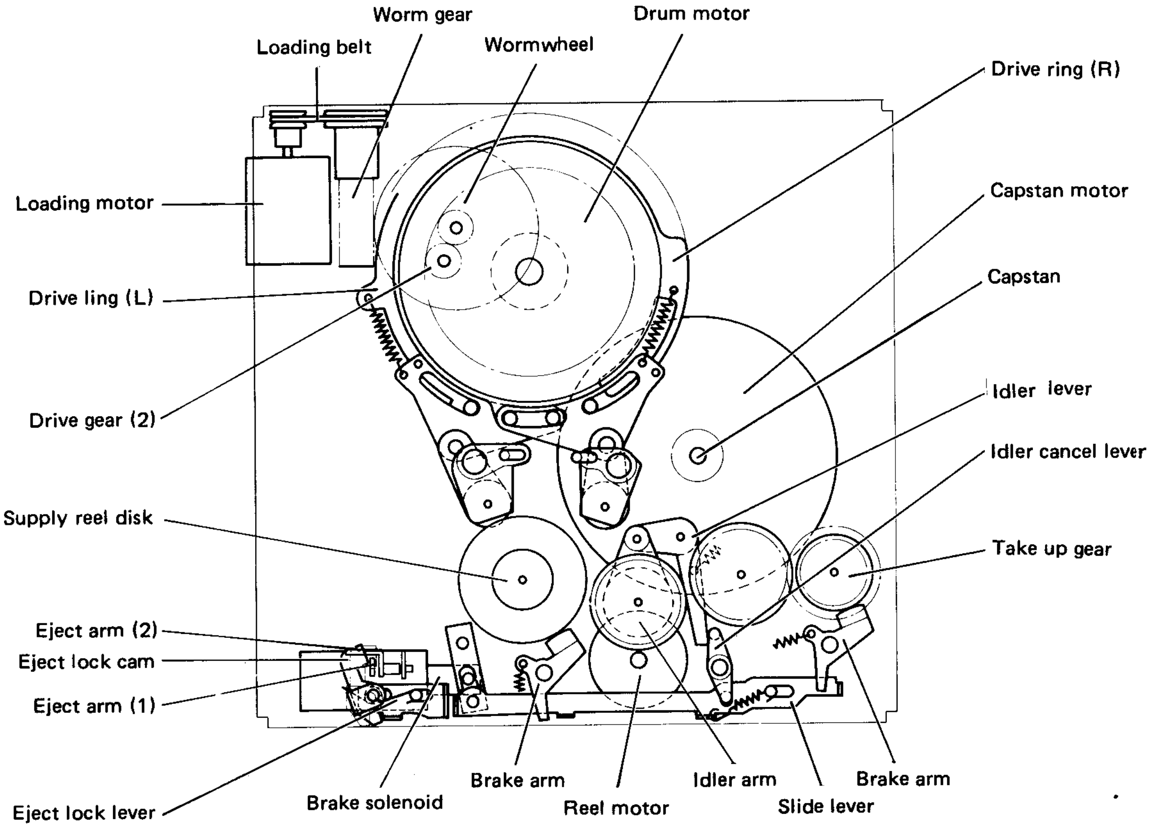

Worm gear
Drum motor
Loading belt
Wormwheel
Drive ring (R)
Loading motor
Capstan motor
Capstan
Drive ling (L)
Idler lever
Drive gear (2)
Idler cancel lever
Supply reel disk
Take up gear
Eject arm (2)
Eject lock cam
Eject arm (1)
Brake arm
Idler arm
Brake arm
Eject lock lever
Brake solenoid
Reel motor
Slide lever

Fig. 2-1

2.1.1 Drum motor

Drives the rotating video heads.

2.1.2 Capstan motor

Drives the capstan in forward and reverse directions.

2.1.3 Reel motor

Drives the take-up pulley or the supply reel disk in forward and reverse directions via an idler arm.

2.1.4 Loading motor

Drives the drive rings in forward and reverse directions.

1. The loading motor rotation is transmitted to the worm gear by the loading belt. The rotation of the worm gear causes the worm wheel to rotate. Two gears are attached to the worm wheel; one directly drives the drive ring (L), and the other drives the drive ring (R) via a drive gear (2). By employing this drive gear (2), the drive ring (R) can be driven in the opposite direction from drive ring (L).

2.1.5 Brake solenoid

Controls the brake arms and the idler arm via a slide lever. Also controls the eject lock system.

1. When the solenoid switches ON, the slide lever is drawn in and moves to the left. Thereby, the bent sections of the brake arms are pushed and the arms are caused to turn clockwise. The brake arms are detached from the supply reel disk and the take-up gear, and the brake pressure is released.
2. When the solenoid becomes ON and the slide lever is moving, the idler cancel lever which rests in a groove on the slide lever starts to turn clockwise. Thereby the idler cancel lever ceases to depress the idler lever, and the idler lever turns counterclockwise, driven by spring force. Now the idler arm attached to it is locked to the reel motor.
3. When the solenoid becomes ON and the slide lever is moving, the bent section on the left tip of the slide lever presses the eject lock lever to the left. The bent section on the eject lock lever trips the eject lock cam and causes it to rotate clockwise. Thereby the eject lock cam blocks the ejecting action of the eject arm (1) in the cassette housing.

2.2 MODE DESCRIPTION

2.2.1 Stop mode

When power is applied, the brake solenoid immediately performs the OFF operation. This design was adopted because the employed brake solenoid is of the latching type, which could become engaged due to an external shock while transporting the unit. In such a case, the eject lock would be activated, preventing the cassette housing from being raised and obstructing the use of a cassette. Therefore, the brake solenoid is designed to first switch OFF, regardless of whether it is actually engaged or not. When the cassette housing is locked and the cassette switch is ON, short Rewind is performed for 0.2 seconds. This serves to take up tape slack if a cassette is inserted.

If the cassette switch is OFF, the brake solenoid switches OFF, but short Rewind is not performed. However, when the cassette housing is lowered and the cassette switch thereby becomes ON, short Rewind is performed for the duration of 1 second. This longer interval is chosen because the inserted cassette is presumed to be set at the tape-end position. With the VHS C system, the luminating part for tape-end detection is located outside of the cassette, and tape-end detection can only be performed after a certain amount of tape was pulled out of the cassette.

Actually, end-of-tape sensing operation is only initiated after the loading process is completed, and therefore loading is performed first, also if the cassette is set at the tape end. During loading the tape is pulled out from the supply side (for details see the section on Loading mode), but because the leader tape is rather short, there is no sufficient amount of tape if the cassette is at the end position, and the tape would therefore be subjected to considerable strain. To prevent this, short Rewind is carried out whether the tape is set at the end or not, to make sure that sufficient tape length is available. The short Rewind operation is similar to the regular Rewind operation, as described in the section on the Rewind mode.

The condition when the eject lock is released and a cassette can be inserted or removed is called the Stop mode. In this condition, the drum, reel, capstan and loading motors are all stationary. Also, the brake arms are applied to the supply reel disk and the take-up gear, to prevent uncontrolled rotation of the cassette reels and tape slackening. The supply pole base, take-up pole base and the tension pole are positioned in readiness for extracting the tape from the cassette, that is within the cassette if one is inserted. Of course, the pinch roller is separated from the capstan so as not to interfere with cassette insertion or removal. The movable audio/control head is now positioned so as not to obstruct the movement of the take-up pole base for the loading process.

The idler arm is in a center position released from both the supply reel disk and the take-up pulley. The ON or OFF condition of the cassette switch depends on the position (raised or lowered) of the cassette housing, but the unloading switch is ON and the loading switch is OFF.

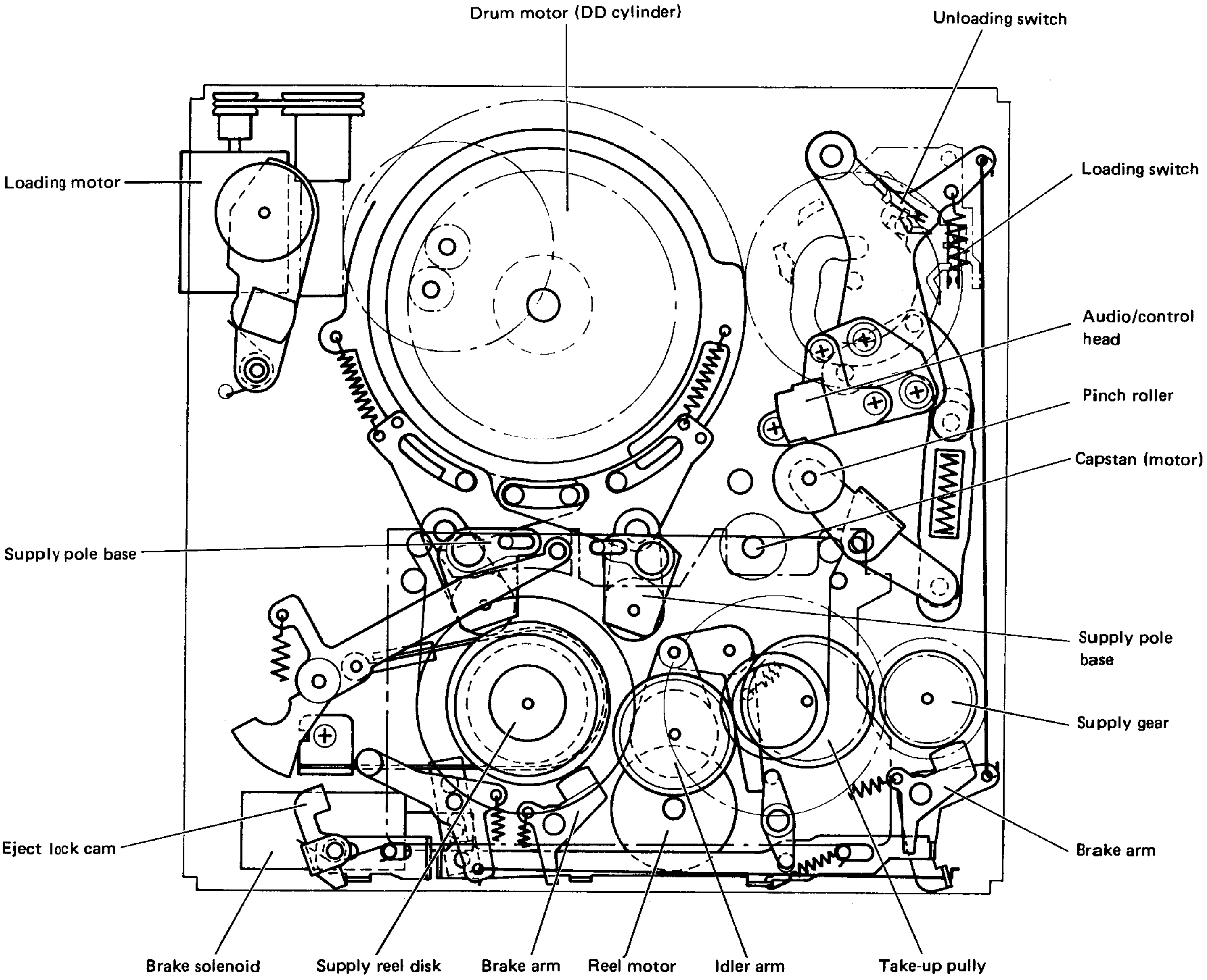

Drum motor (DD cylinder)
Unloading switch
Loading motor
Loading switch
Audio/control head
Pinch roller
Capstan (motor)
Supply pole base
Supply pole base
Supply gear
Eject lock cam
Brake arm
Brake solenoid
Supply reel disk
Brake arm
Reel motor
Idler arm
Take-up pully

Fig. 2-2

2.2.2 Fast-forward (FF) mode

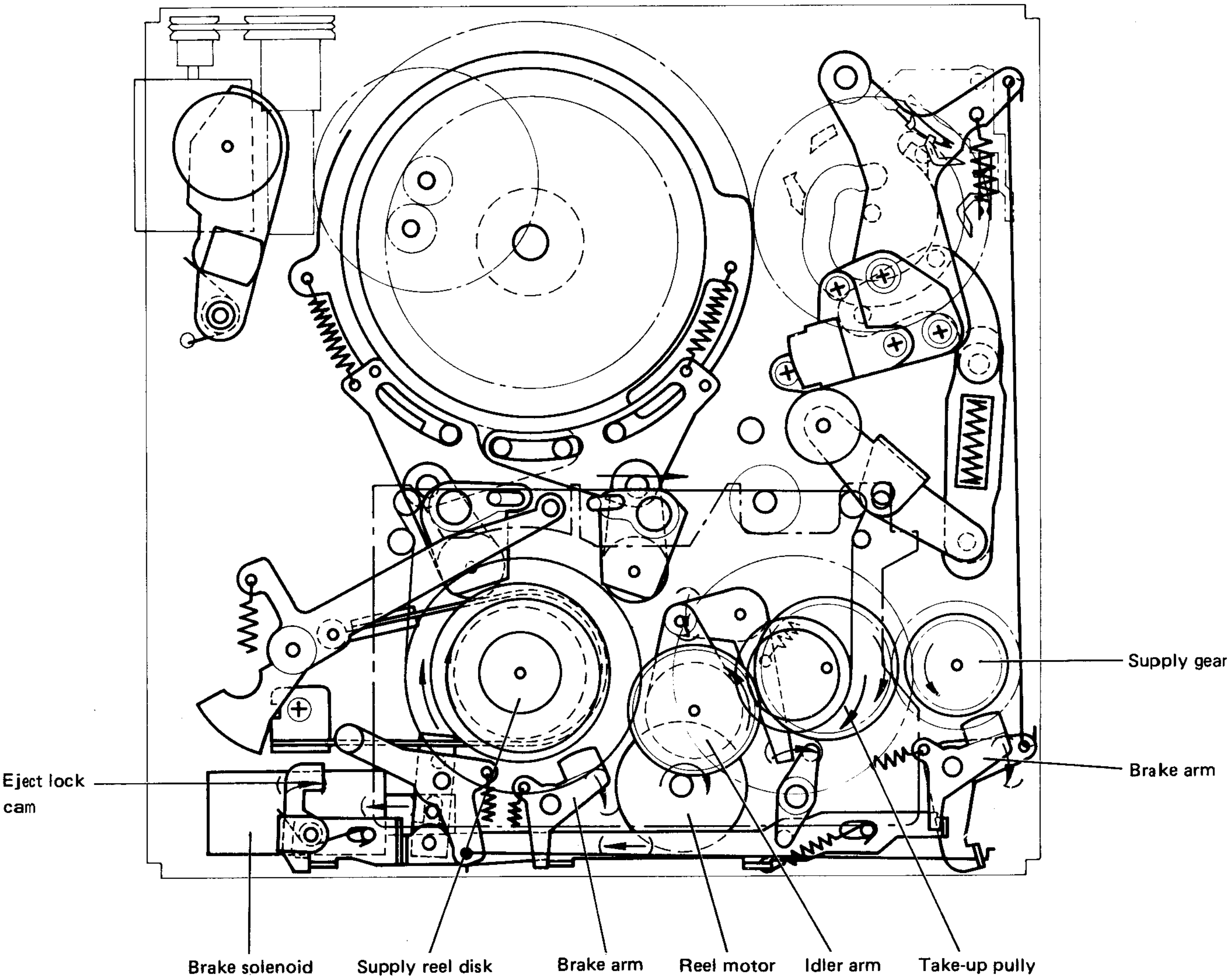
When the FF button is pressed in the Stop mode, the brake solenoid becomes ON and the reel motor starts rotating clockwise. If the FF button was pressed in the Rewind or the Unloading mode, the Stop mode is first entered before changing to the FF mode. When the brake solenoid is ON, the eject lock system becomes active, to prevent accidental raising of the cassette housing in the FF mode. At the same time, the brake arms are released from the supply reel disk and the take-up gear, permitting free rotation. In this condition, the idler arm comes into contact with the reel motor and is pressed by the reel motor's rotation against the take-up pulley, transmitting the motor rotation to the pulley.

The take-up pulley drives the take-up gear which in turn causes the take-up reel inside the cassette to rotate. Thereby the tape is wound from the supply reel onto the take-up reel. The condition when the tape is being wound at high speed directly from the supply reel to the take-up reel without being extracted from the cassette is called the FF mode. The reel motor starts rotating at a lower speed in the initial stage to prevent undue strain from being placed on the tape.

The FF mode is terminated when the STOP, PLAY or REW key is pressed or if the tape end is detected. When the STOP switch is pressed in the FF mode, the reel motor is immediately stopped, and the brake solenoid becomes OFF, causing the brake arms to contact the supply reel disk and the take-up pulley, thereby stopping the reel rotation. At the same time, the idler arm is released from the take-up pulley and the reel motor. The eject lock is also released and the Stop mode is entered momentarily, after which short Rewind of approx. 0.2 seconds is performed, to wind up any take slack onto the supply reel. Then the Stop mode is entered again.

When the PLAY or REW button was pressed in the FF mode, the Stop mode is also entered momentarily, but short Rewind is not performed and the Loading mode or Rewind mode is entered directly.

When the tape end was detected, the operation is practically the same as when the STOP button was pushed, but the duration of short Rewind is extended to approx. 1 second, to provide sufficient tape length on the supply reel for loading. Tape-end detection is performed by detecting the rotation of the supply reel disk. Therefore, when the reel disk has stopped, a considerable strain is placed on the tape for approx. 1 second, as this is the required interval until the reel motor stops after the rotation of the reel disk has ceased. However, this strain is alleviated by the clutch action of the take-up gear.


Supply gear
Brake arm
Eject lock cam
Brake solenoid
Supply reel disk
Brake arm
Reel motor
Idler arm
Take-up pully

(→) Shift from stop to FF mode
→ FF mode operation

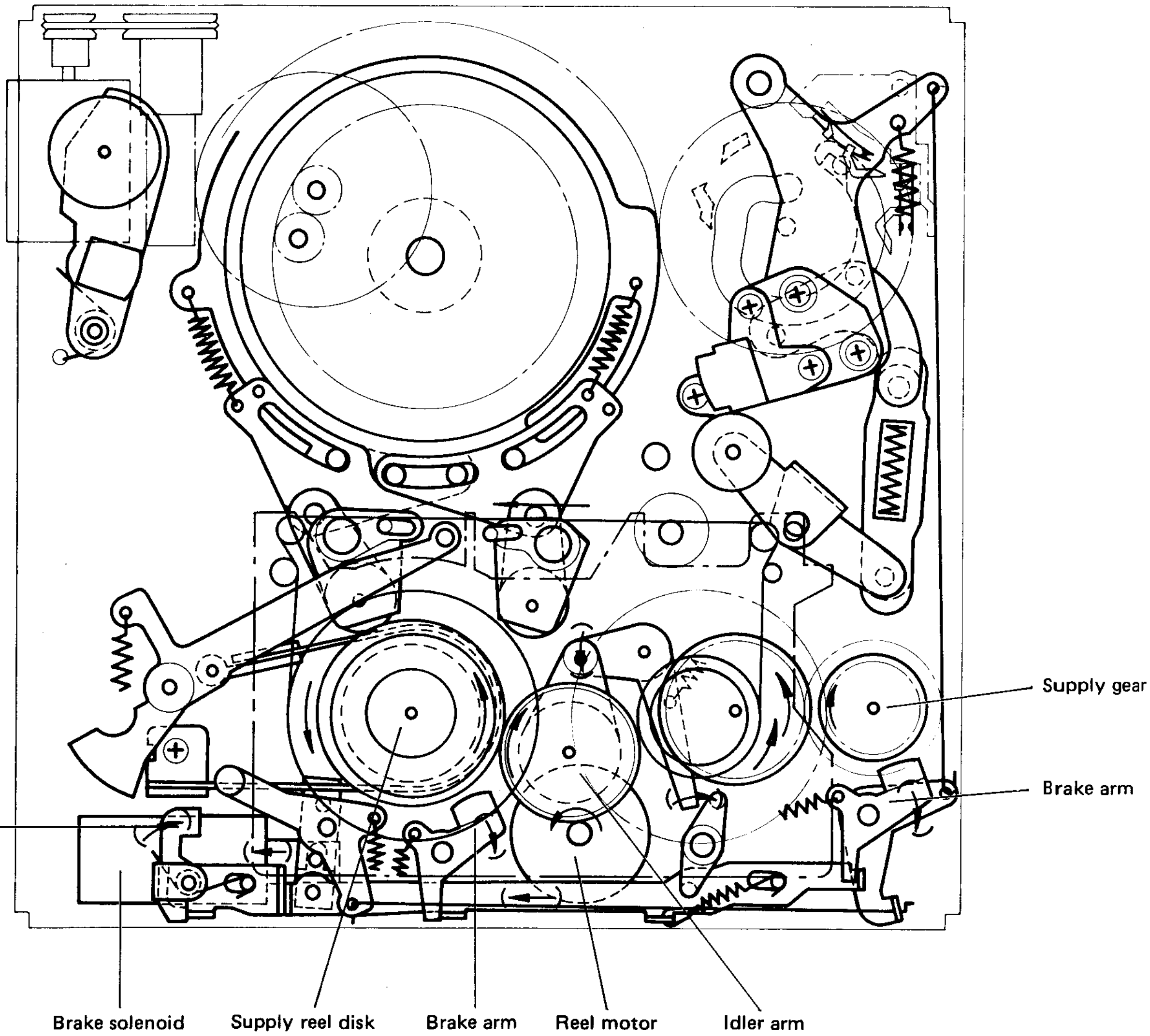
Fig. 2-3

2.2.3 Rewind (REW) mode

When the REW button is pressed in the Stop mode, the brake solenoid becomes ON and the reel motor starts rotating counterclockwise. If the REW button was pressed in the FF mode or the Unloading mode, the Stop mode is first entered before changing to the Rewind mode. The eject lock system becomes active to prevent raising of the cassette housing. The brake arms are released and at the same time the reel motor brings the idler arm into contact with the supply reel disk, transmitting the motor rotation. Thereby, the tape is being wound directly from the take-up reel onto the supply reel at high speed without being extracted from the cassette. This condition is called the Rewind mode.
The reel motor starts rotating at a lower speed in the initial stage to prevent undue strain from being placed on the tape.

The Rewind mode is terminated when the STOP, PLAY or FF button is pressed or when the tape end is detected. When the STOP switch is pressed, the reel motor immediately stops and the brake solenoid becomes OFF, activating the brake arms to stop the tape winding. The unit momentarily enters the Stop mode, but then short Rewind of approx. 0.2 seconds is performed, to wind up any tape slack onto the supply reel. Then the Stop mode is entered again.

When the PLAY or FF button was pressed, the Stop mode is also entered momentarily, but short Rewind is not performed and the Loading mode or Rewind mode is entered directly. When the tape end was detected, after momentarily entering the Stop mode, approx. 1 second of Short FF is performed and then the Stop mode is entered again. If the tape is left at the very beginning, a large strain would be placed on it the next time it is lowered in the cassette housing for use, setting the cassette switch to ON and causing short Rewind to be performed. The programmed short FF serves to prevent this condition. Because there is still a possibility that a cassette will be used from the very beginning, the supply reel disk employs a clutch construction to reduce the strain on the tape in such a case. The main aim of this construction is also to alleviate the considerable strain placed on the tape during tape end detection. This detection is performed by detecting rotation of the take-up gear. After the take-up gear rotation has stopped, approx. 1 second is needed until the reel motor switches off.


Supply gear
Brake arm
Eject lock cam
Brake solenoid
Supply reel disk
Brake arm
Reel motor
Idler arm

(→) Shift from stop to REW mode
→ REW mode operation

Fig. 2-4

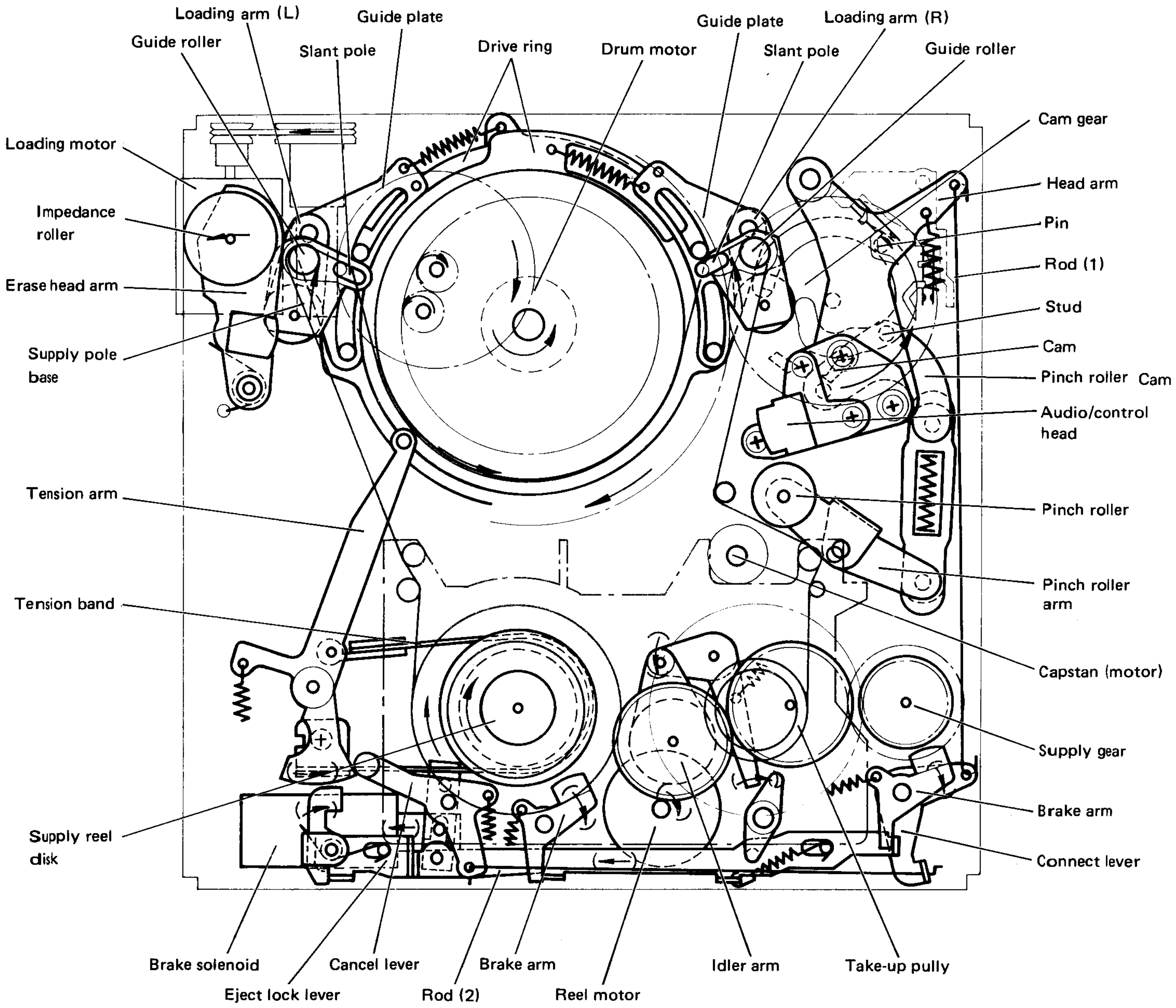
2.2.4 Loading mode

The condition while the tape is being extracted from the cassette and positioned in the transport is called the Loading mode. When the PLAY button is pressed in the Stop mode, the brake solenoid becomes ON and the reel motor starts rotating clockwise. When the PLAY button was pressed in the FF or Rewind mode, the Stop mode is entered first before proceeding to the Unloading mode. The brake arms are released and the idler arm is pressed against the take-up pulley by the reel motor rotation. The drum motor also starts to rotate. When the reel motor rotation stops, the loading motor starts to operate, activating the drive rings.

A pole base is attached to the loading arm on both sides of the main deck. The loading arms are connected to guide plates incorporated in the drive rings. Prompted by the drive ring rotation, the pole bases move in the narrow grooves on top of the main deck. Thereby the slanted poles on top of the pole bases and the guide rollers extract the tape from the cassette. Because the idler arm is in loose contact with the take-up pulley, exterting a braking influence, the take-up gear's clutch torque serves as a loading brake. As the supply reel can rotate freely at this time, the tape extracted during the loading process is supplied almost entirely from the supply reel.
In Stop mode, the tension arm is held in place by the supply pole base, but when the Loading mode is entered and the supply pole base shifts, spring force turns the tension arm counterclockwise, until it is stopped by the cancel lever. When the tension arm shifts, a part of it blocks the eject arm (2) inside the cassette housing, causing eject lock. This may seem to be unnecessary because in the Loading mode the brake solenoid will not become OFF under any circumstances, but actually it is required for the REC Lock Power-off mode. As loading continues, the supply pole base moves the tape while pushing the erase head arm out of the way. When the supply pole base has passed, the erase head arm returns to its original position by spring force, and the impedance roller contacts the tape.

The impedance roller serves to dampen vertical vibrations of the tape, which can contribute to picture jitter and audio wow-and-flutter. At about the point when the supply pole base pushes the erase head arm away, the action of the cam gear locked to the drive gear sets the audio/control head and the pinch roller in motion. The pinch roller is connected to the pinch roller cam, whose stud in turn rests in a groove on the cam gear. The audio/control head is fixed to a head arm, whose pin also rests in a groove on the cam gear across the main deck. Therefore, the pinch roller cam and the head arm follow the groove motion of the cam gear and rotate accordingly. When the head arm rotates clockwise, the cancel lever connected via a connect lever and rods also starts rotating clockwise by spring force. This causes the tension arm to again start rotating counterclockwise. Immediately before completion of the loading process the tension arm is fully extended, thereby thgitening the tape and causing the tension band to act on the supply reel disk. This exerts a braking influence and serves to prevent tape slackening caused by inertia during the loading motion. The clockwise rotation of the cancel lever depresses the eject lock lever by spring force, maintaining the eject lock. This is necessary because the brake solenoid can become OFF even with extracted tape in the Pause mode, etc.

When the tension arm is fully extended, the cam of the cam gear driven by the drive ring depresses the loading switch, setting it ON. Now the capstan motor and the reel motor start rotating. The cam gear continues to rotate, and when it sets the loading switch again to OFF, the tape is completely set in the transport system. The tape is engaged between the pinch roller and capstan, and tape transport starts. The Play mode is now entered, but the drive rings still continue to rotate and drive the cam gear for some time.


Loading arm (L)
Guide plate
Guide plate
Loading arm (R)
Guide roller
Slant pole
Drive ring
Drum motor
Slant pole
Guide roller
Cam gear
Loading motor
Head arm
Impedance roller
Pin
Rod (1)
Erase head arm
Stud
Supply pole base
Cam
Pinch roller Cam
Audio/control head
Tension arm
Pinch roller
Tension band
Pinch roller arm
Capstan (motor)
Supply gear
Brake arm
Supply reel disk
Connect lever
Brake solenoid
Cancel lever
Brake arm
Idler arm
Take-up pully
Eject lock lever
Rod (2)
Reel motor

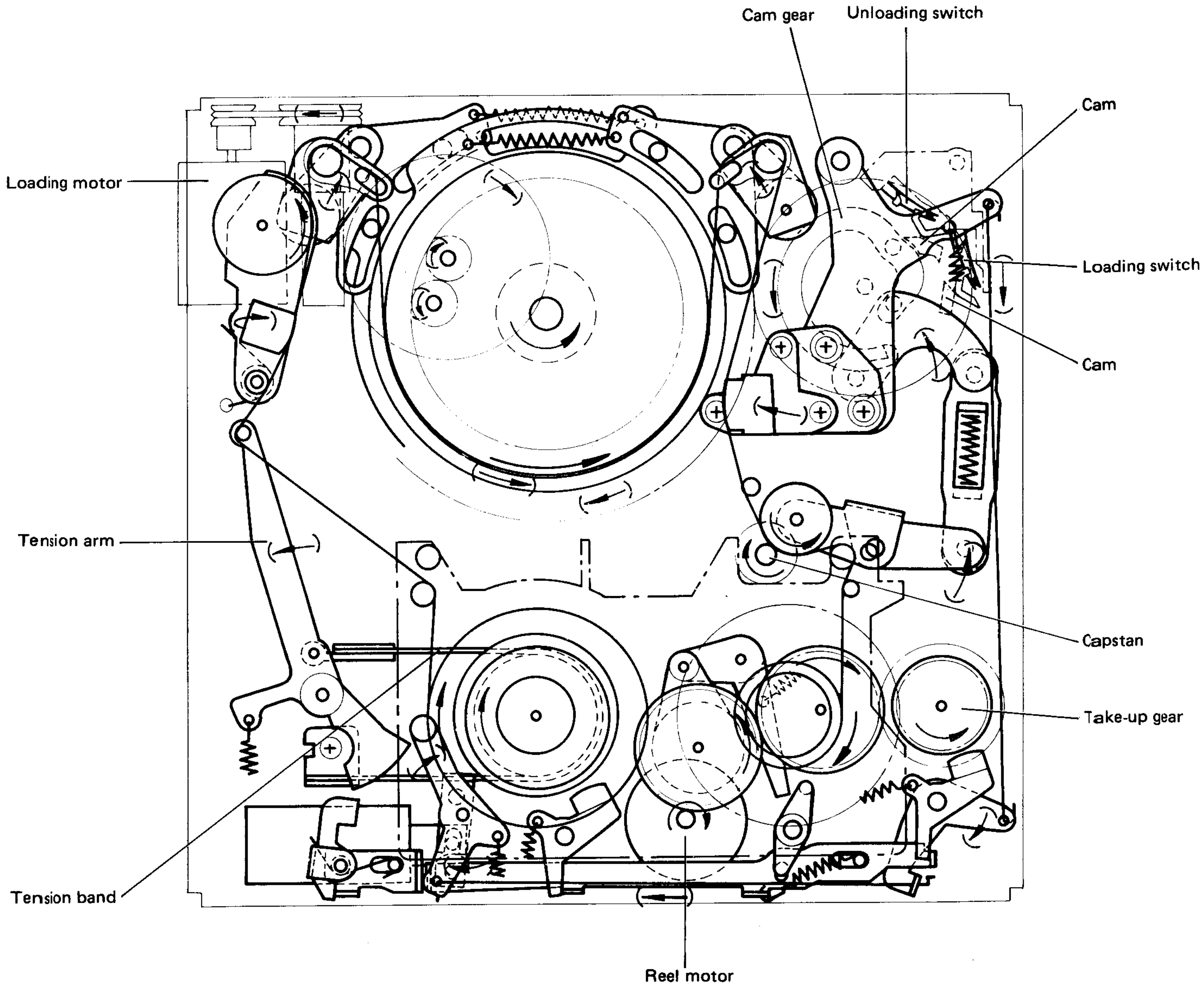
(→) Shift from stop to Loading mode
→ Loading mode operation

Fig. 2-5

2.2.5 Play mode

The loading motor still rotates after the tape transport has started, but soon the cams of the cam gear press the loading switch and the unloading switch at about the same time. When both switches become ON simultaneously, the loading motor which has driven the drive rings stops.

In the Play mode, the tape is transported by the capstan rotation and wound onto the take-up reel which is driven by the reel motor via the take-up gear.
The amount of tape being forwarded by the capstan is constant, but the revolution speed of the take-up reel depends on the diameter of the tape pack on the reel. The clutch construction of the take-up gear allows for smooth compensation of these parameters. Tape tension is controlled by the tension arm and tension band. This mechanical tension servo system maintains constant tape tension at the drum input regardless of changing reel pack diameters.


Cam gear
Unloading switch
Cam
Loading motor
Loading switch
Cam
Tension arm
Capstan
Take-up gear
Tension band
Reel motor

(→) Shift from Loading to play mode
→ Play mode operation

Fig. 2-6

2.2.6 Pause mode

1. Play Pause mode

   When the PAUSE button is pressed in the Play mode, the capstan stops to interrupt the tape transport. Next, the reel motor stops, interrupting the winding of the tape, and the brake solenoid becomes OFF, activating the brake arms. Because the cancel lever keeps the eject lock lever in position also when the brake solenoid is OFF, there is no danger of damage to the tape by accidental raising of the cassette housing.

   In the Pause mode, the pinch roller remains engaged to the capstan and the tension arm is also in contact with the tape. Because the tape is stationary, the rotating video heads continue to trace the same portion of the tape. This would necessarily lead to increased tape wear if the same tape tension as during ordinary playback were maintained. Therefore, the tape tension is lowered by introducing a slight delay between the stop of the capstan motor and the operation of the brake arms through the brake solenoid OFF.

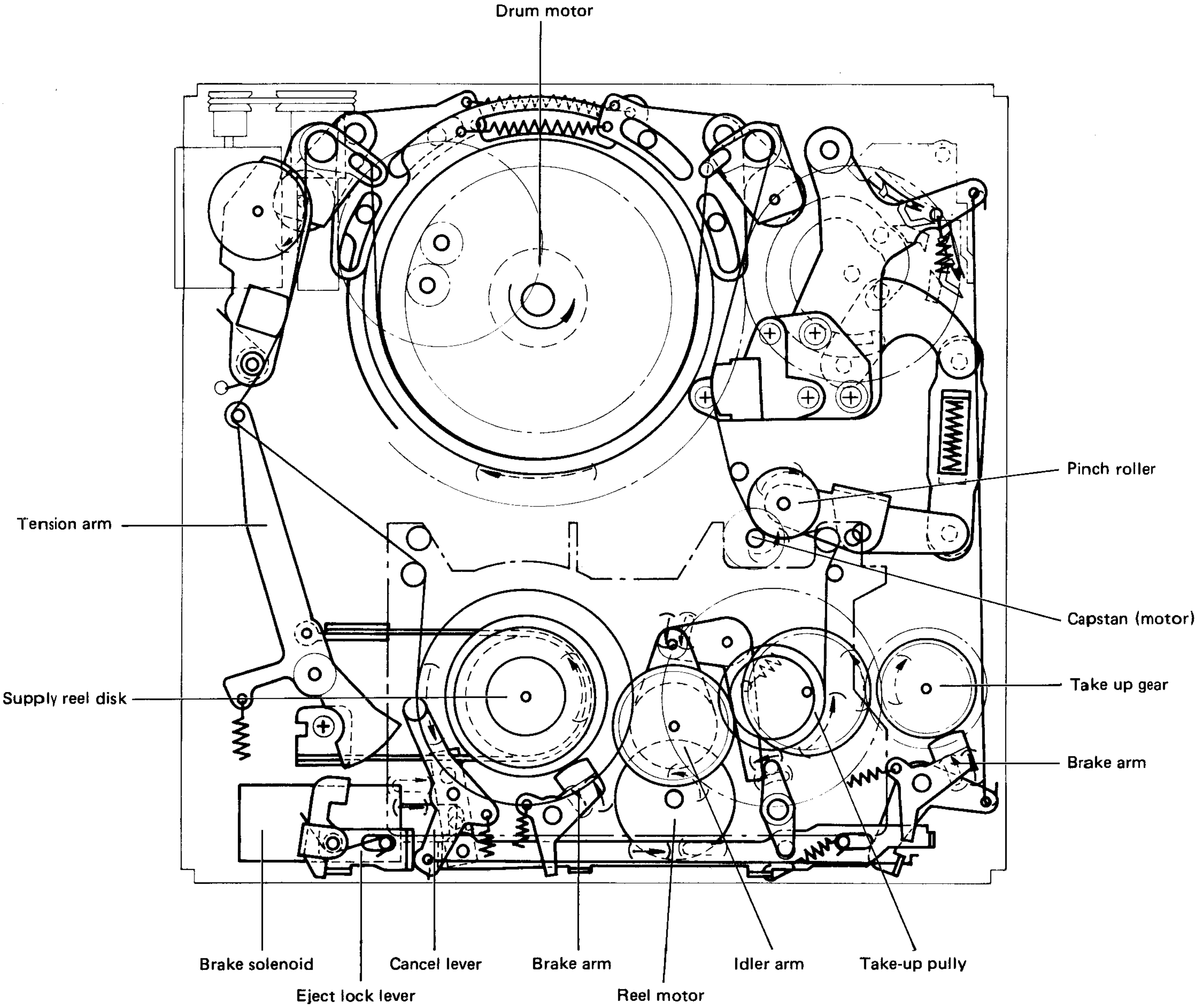
   When the PLAY button is pressed again, the brake solenoid becomes ON and the brake arms are released. The reel motor starts to rotate, bringing the idler arm into contact with the take-up pulley and thereby driving the take-up gear. The capstan motor also starts rotation and the tape transport is resumed with the tape being wound by the take-up gear as in the original Play mode.

2. Record Pause mode

   When the PAUSE button is pressed in the Record mode, the Pause mode is entered momentarily, but the brake solenoid becomes ON immediately afterwards, releasing the brake arms. At the same time, the reel motor turns countercloxkwise, bringing the idler arm into contact with the supply reel disk to transmit the motor rotation.

   The capstan motor also turns counterclockwise, pulling the tape from the take-up reel and transporting it towards the drum side. The tape passes the drum and transport system in reverse and is wound onto the supply reel. This back-spacing operation is performed for approx. 1 second. Then the brake solenoid beocmes OFF and the reel motor stops, thereby stopping the tape transport and activating the reel brakes. The capstan motor also stops turning with a short delay after the brake solenoid became OFF to ease the tape tension and reduce tape wear.

   When the PLAY switch is pressed, the brake solenoid becomes ON and the brake arms are released. The reel motor starts to rotate clockwise, bringing the idler arm into contact with the take-up pulley and thereby driving the take-up gear. The capstan motor also starts clockwise rotation and the tape transport is resumed. The Play mode is entered with the tape being forwarded by the capstan and wound onto the take-up reel by the take-up gear.


Drum motor
Pinch roller
Tension arm
Capstan (motor)
Supply reel disk
Take up gear
Brake arm
Brake solenoid
Cancel lever
Brake arm
Idler arm
Take-up pully
Eject lock lever
Reel motor

(→) Shift from play to play pause mode
(-→) Shift from play pause to REC pause mode
→ Play pause and REC pause operation

Fig. 2-7

2.2.7 REC Lock Power-off mode

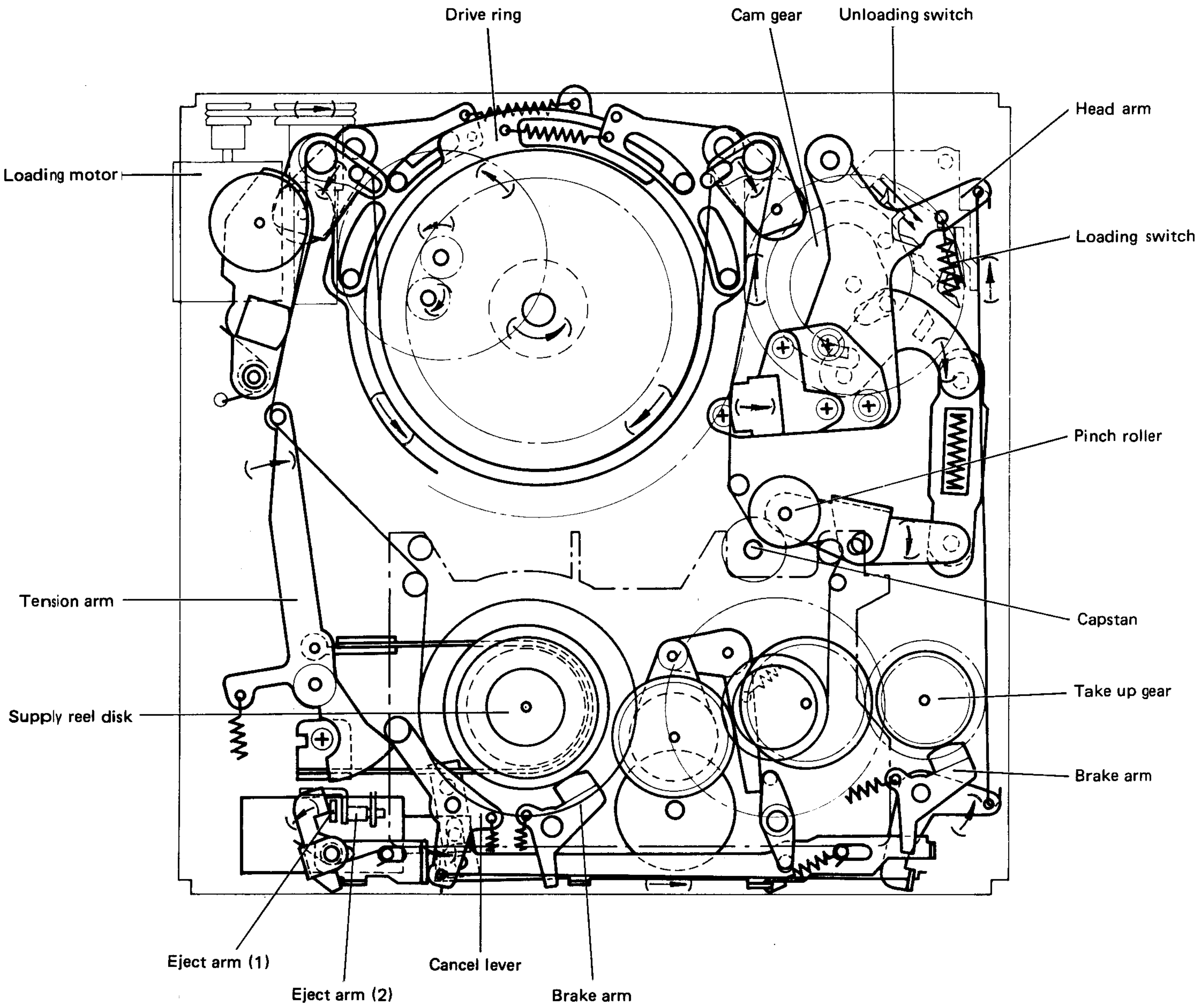
When the power switch is set to OFF during the Recording mode with the REC LOCK switch set to ON, the Pause mode is entered momentarily. Immediately afterwards the back-space operation is performed for approx. 1 second and then Record Pause mode is entered. Even in this mode, the power is not switched off yet, because the REC LOCK switch will be used for comparatively long switch-off periods, making it necessary to disengage the pinch roller from the capstan. As the engaging of the pinch roller is a mechanical operation performed in conjunction with the loading process, it is necessary to perform very brief unloading in order to separate the pinch roller from the capstan.

When the Record Pause mode is entered, the loading motor immediately starts to rotate, activating the drive rings. The drive ring turns the cam gear, which sets the loading switch and the unloading switch to OFF. The cam gear continues to turn, and when it sets the loading switch to ON again, the loading motor stops and the unloading action is terminated. At the same time, the drum motor stops and the power is switched off. The unloading action in this process does not include winding the tape onto the supply reel, so as not to disturb the editing point.

In the REC Lock Power-off mode, the pinch roller is disengaged slightly from the capstan, but the tape is held in place because the brake arms act on the supply reel disk and the take-up gear. Due to the brief unloading action, the head arm has also turned a little counterclockwise. This has released the cancel lever in the counterclockwise direction, thereby disabling the eject lock although the brake solenoid has become OFF. This might be thought to place the tape in danger of being damaged by raising of the cassette housing, but actually a section of the tension arm blocks the eject arm (2) in the cassette housing and prevents ejecting of the cassette.

When the power is switched on again, the loading motor starts to operate, causing loading to be performed, after which the Record Pause mode is entered.

When a camera is connected, the Record Pause mode is maintained in this condition. When no camera is connected, the Record mode is entered after 3 seconds. The drum motor starts to rotate immediately when the power is switched on.


Drive ring
Cam gear
Unloading switch
Head arm
Loading motor
Loading switch
Pinch roller
Tension arm
Capstan
Take up gear
Supply reel disk
Brake arm
Eject arm (1)
Cancel lever
Eject arm (2)
Brake arm

(→) Shift from REC pause to REC lock power-off mode

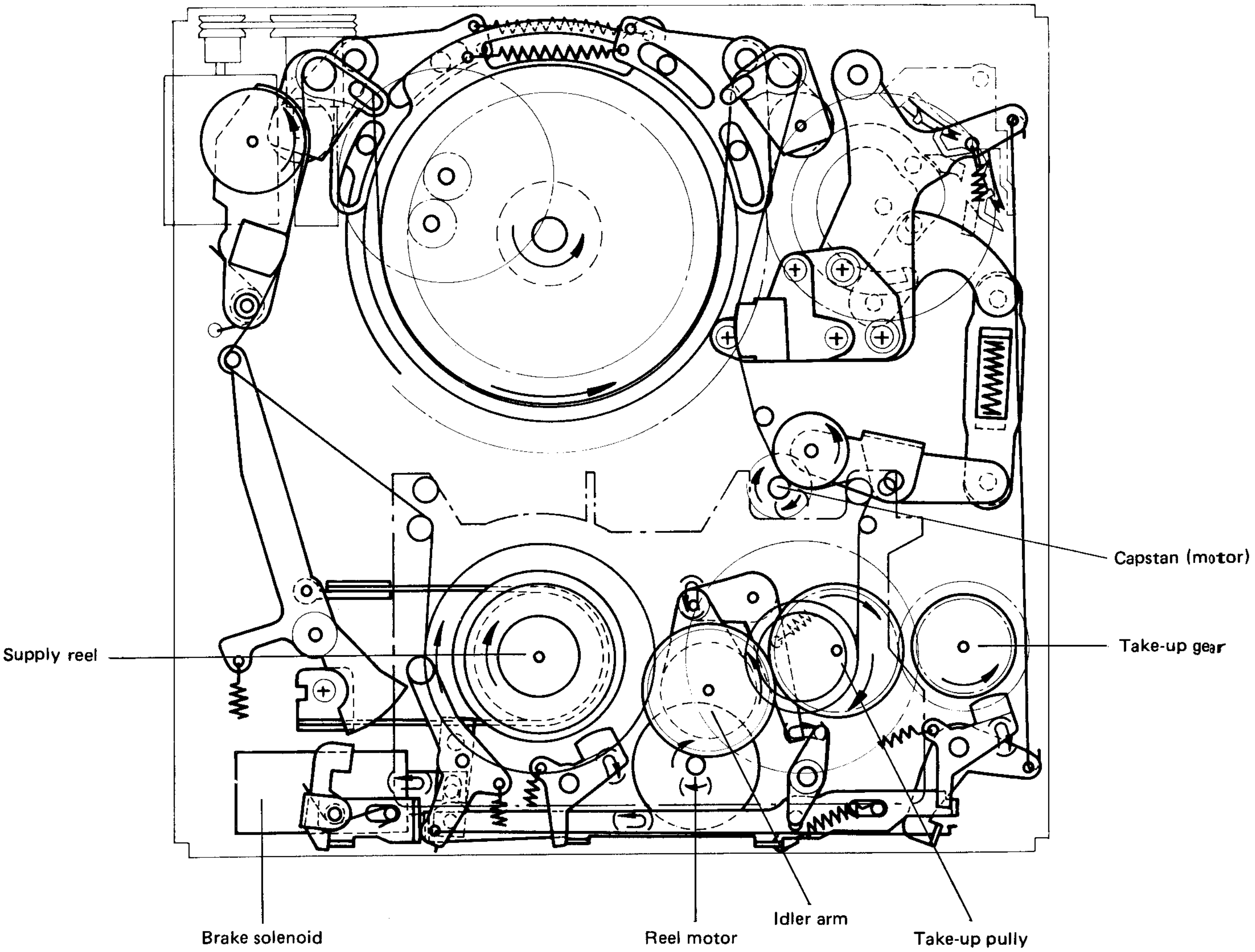
Fig. 2-8

2.2.8 Search FF mode

When the FF button is being kept depressed in the Play mode, the capstan motor stops rotating, the brake solenoid becomes OFF, and the Play Pause mode is entered. Immediately afterwards the brake solenoid becomes ON again and the reel motor starts turning clockwise, bringing the idler arm into contact with the take-up pulley and driving the take-up gear. The capstan motor also starts to rotate clockwise and the tape is transported with approx. 3 times the speed of the normal Play mode.

Except for the fact that the capstan motor and reel motor rotation is speeded up, the other parameters are the same as for the Play mode. Because the capstan forwards the tape at a higher rate, the reel motor is driven with approx. double voltage as compared to the Play mode.

When the FF button is released, the capstan motor stops, interrupting the tape transport, the brake solenoid becomes OFF and the reel motor also stops. Thus the Play Pause mode is entered momentarily, but immediately afterwards the brake solenoid again becomes ON, the reel motor and capstan motor start turning clockwise, and the Play mode is entered.
If the tape end is detected during Search FF, the Play Pause Pause mode is entered.



(→) Shift from play to Search FF mode
→ Search FF mode operation

Fig. 2-9

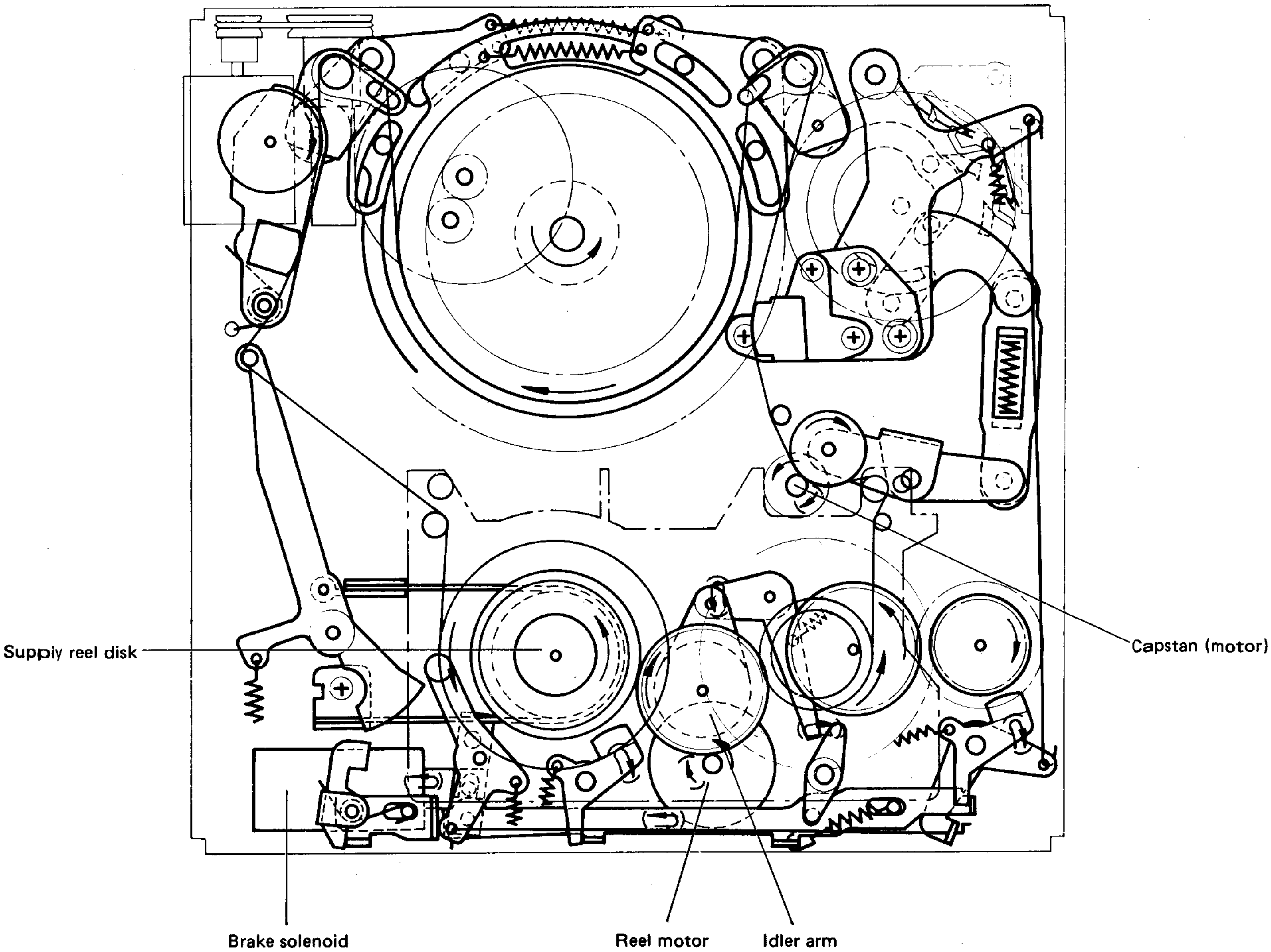
2.2.9 Search Rewind mode

When the REW button is being kept depressed in the Play mode, the capstan motor stops rotating, the brake solenoid becomes OFF, and the Play Pause mode is entered. Immediately afterwards the brake solenoid becomes ON again and the reel motor starts turning counterclockwise, drivning the supply reel disk via the idler arm. The capstan motor also starts to rotate counterclockwise and the tape is transported in reverse with approx. 3 times the speed of the normal Play mode.

Whereas in the Search FF mode the tape can be directly wound onto the take-up reel, in the Search Rewind mode it must be pulled past the drum and transport system in reverse and wound onto the supply reel. As this presents a greater load, the drive voltage of the reel motor is set to a still higher value than in Search FF.

When the REW button is released, the Play Pause mode is entered momentarily, and then the original Play mode is resumed.

If the tape end is detected during Search Rewind, the Play Pause mode is entered.

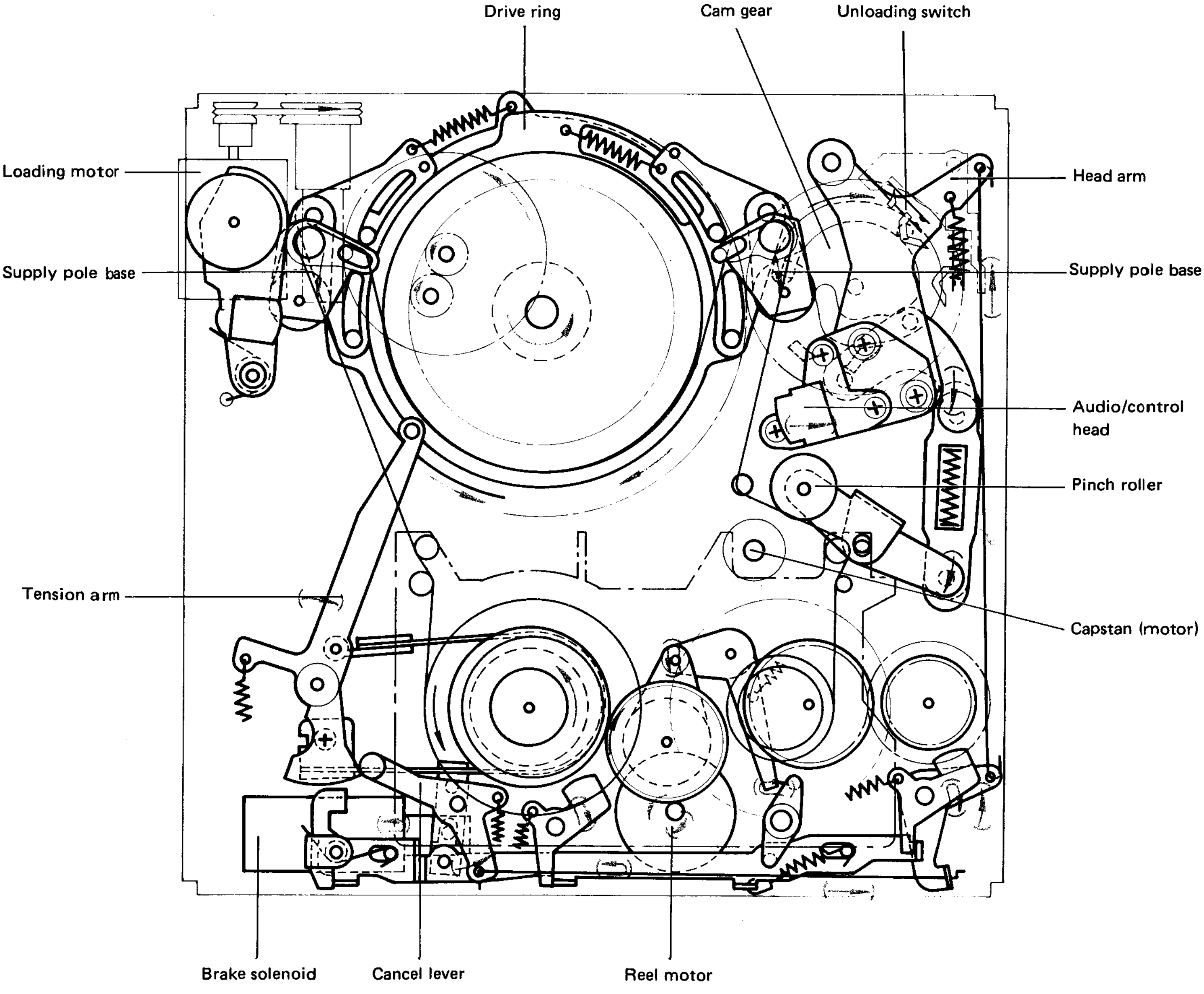


(→) Shift from Play to Search REW mode
→ Search REW mode operation

Fig. 2-10

2.2.10 Unloading mode

When the Stop button is pressed or the tape end is detected in the Play mode, the capstan motor stops, halting the tape transport. The reel motor also stops and the brake solenoid becomes OFF. After approx. 0.5 seconds the brake solenoid again becomes ON and the reel motor and loading motor start rotating. The loading motor activates the drive rings, starting to move the pole bases towards the cassette. The reel motor turns counterclockwise, turning the supply reel disk via the idler arm and winding the tape onto the supply reel. The cam gear driven by the drive ring releases the head arm in the counterclockwise direction and the pinch roller in the clockwise direction. Prompted by the revolution of the head arm, the cancel lever turns counterclockwise while pushing the tension arm. Afterwards the head arm swings the autio/control head to a position where it does not interfere with the movement of the take-up pole base. The cancel lever also removes the tension arm sufficiently from the tape. Finally the supply pole base – while pushing the tension arm – and the take-up pole base retract into the cassette. At this point, the cam gear driven by the drive ring depresses the unloading switch, setting it to ON. At the same time, the loading motor and the reel motor stop. The brake solenoid also becomes OFF, but after approx. 0.5 seconds it becomes ON again. The drum motor now stops and short Rewind is performed for approx. 0.2 seconds. Then the Stop mode is entered.


Drive ring
Cam gear
Unloading switch
Loading motor
Head arm
Supply pole base
Supply pole base
Audio/control head
Pinch roller
Tension arm
Capstan (motor)
Brake solenoid
Cancel lever
Reel motor

(→) Shift from Play to Unloading mode
→ Unloading mode operation

Fig. 2-11

SECTION 3
CIRCUIT DESCRIPTION

3.1 MECHANISM CONTROL CIRCUIT

3.1.1 Microprocessor HD44820

The mechanism control (mechacon) circuit includes a one-chip microprocessor (HD44820). Due to space limitations, input and output data expansion techniques are not employed and the 54-pin microprocessor alone is used for controlling the mechacon circuit.

Description of HD44820 4-bit microprocessor
Signle-chip 4-bit microprocessor 54 pins CMOS

Power supply voltage	:	5 V
Power consumption	:	0.8 mA
Clock frequency	:	400 kHz

1. Input terminal configuration
   1) Input pins 36 and 37
   2) Without pull-up MOS
   3) Input

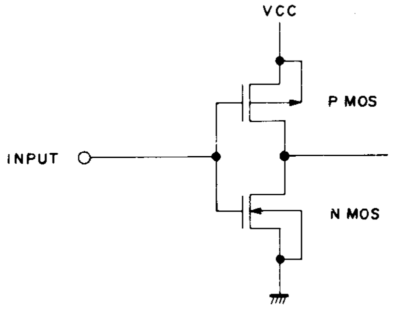

VCC
P MOS
INPUT
N MOS

Fig. 3-1

2. Output terminal configuration
   1) Output pins 46 to 49
      CMOS output
      Output

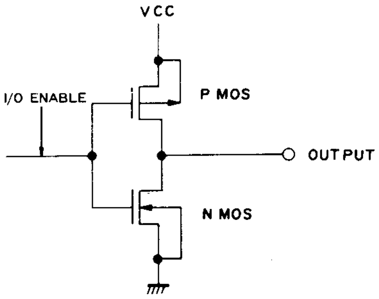

VCC
I/O ENABLE
P MOS
OUTPUT
N MOS

Fig. 3-2

   2) Pins 50 to 53 and 44
      Open-drani output
      Output

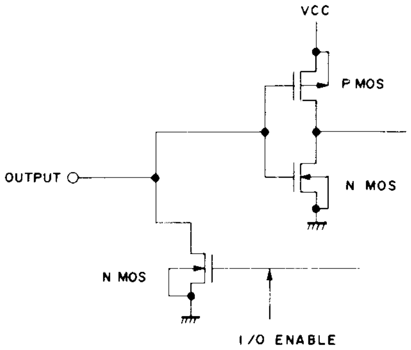

VCC
P MOS
OUTPUT
N MOS
N MOS
I/O ENABLE

Fig. 3-3

   3) Pins 1 to 5
      Pins 13 to 16
      Open-drain, with pull-up MOS
      Output

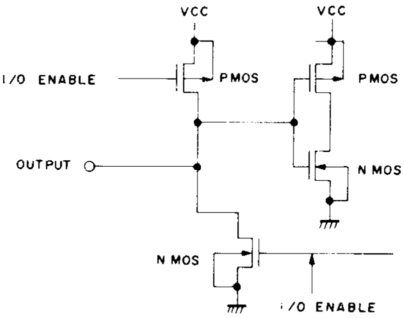

VCC
VCC
I/O ENABLE
PMOS
PMOS
OUTPUT
N MOS
N MOS
I/O ENABLE

Fig. 3-4

   4) Pins 6 to 12, 17 to 20, 28 to 35, 38 to 43 and 45
      Output

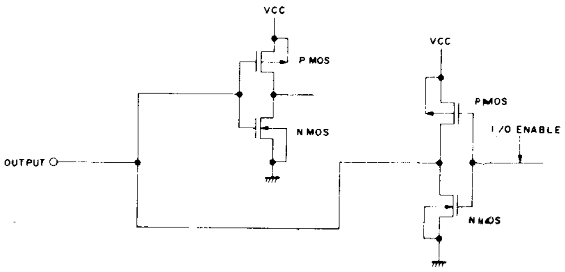

VCC
P MOS
N MOS
VCC
PMOS
I/O ENABLE
OUTPUT
NMOS

Fig. 3-5

   5) Pin 26 : Normally high potential, low during test.
      Pin 21 : High potential at reset, low potential during operation.

3.1.2 Block diagram description

As can be noted from the block diagram, circuit composition is simpler than earlier mechacon systems. IC1 is a 54-pin microprocessor and, in absence of expander circuits, input and output data are applied directly.

Output data are employed for controlling the reel, loading, capstan and drum motors, and the brake solenoid. Control is also performed for the audio muting, audio dub, audio recording, video E-E, video recording and other circuits.

- Circuit Functions

1. Reset pulse generator (IC2)
   This performs initial reset for the microprocessor. Normally low potential, reset is performed by a high pulse of more than 400 msec.
2. Reel speed control (RA1)
   4-bit data from the CPU are applied to resistor array RA1, which produces a 15-step voltage variation for controlling the reel motor speed.
3. Key scan circuit (IC3, RA2 and RA3)
   The ladder principle is used for the inputs from both the mainframe and remote control unit operating buttons. The 5 V power supply voltage results in a voltage variation of approximately 0.3 V per step.
4. Tape counter
   A special IC is employed for the tape counter and remaining time indication. Approximataly 1 hour back-up is provided by C3 (0.1 μF).

3.1.3 Circuit operations

1. Power on/off control
   Power can be switched on and off from the mainframe POWER button, the remore control unit, or a connected camera. The power on/off operation is performed by latching relay RY1 of the servo board. Fig. 3-6 illustrates the relay drive circuit.

(1) Power on operation

Pressing the POWER button (S9) switches Q18 and Q19 on. During the initial power on operation, although the power on signal is sent to IC7, regulated 5 V is not supplied. Therefore, IC7 and IC1 do not operate.

A CR circuit differentiates the power on signal, which is then supplied to Q12. This transistor switches on only during the negative pulse interval, at which time, Q13 switches on. Current then flows in the RY1 coil, switching the relay on and supplying unregulated 12 V to the circuits.

Similarly, a power on signal supplied via pin 4 of the camera connector is differentiated and sent to Q11 and Q13, thus activating the relay.

Separate circuits are used for the power on functions of the camera and mainframe, since with some camera models, the pin 4 is grounded. Therefore, the separate circuits prevent disabling of the mainframe power function if this type of camera is connected.

The power on signal is supplied by the following methods:

1) Mainframe POWER button (S9) set to on,
2) Power button of remote control unit depressed,
3) Camera power switch set to on (when camera model is equipped with this feature).

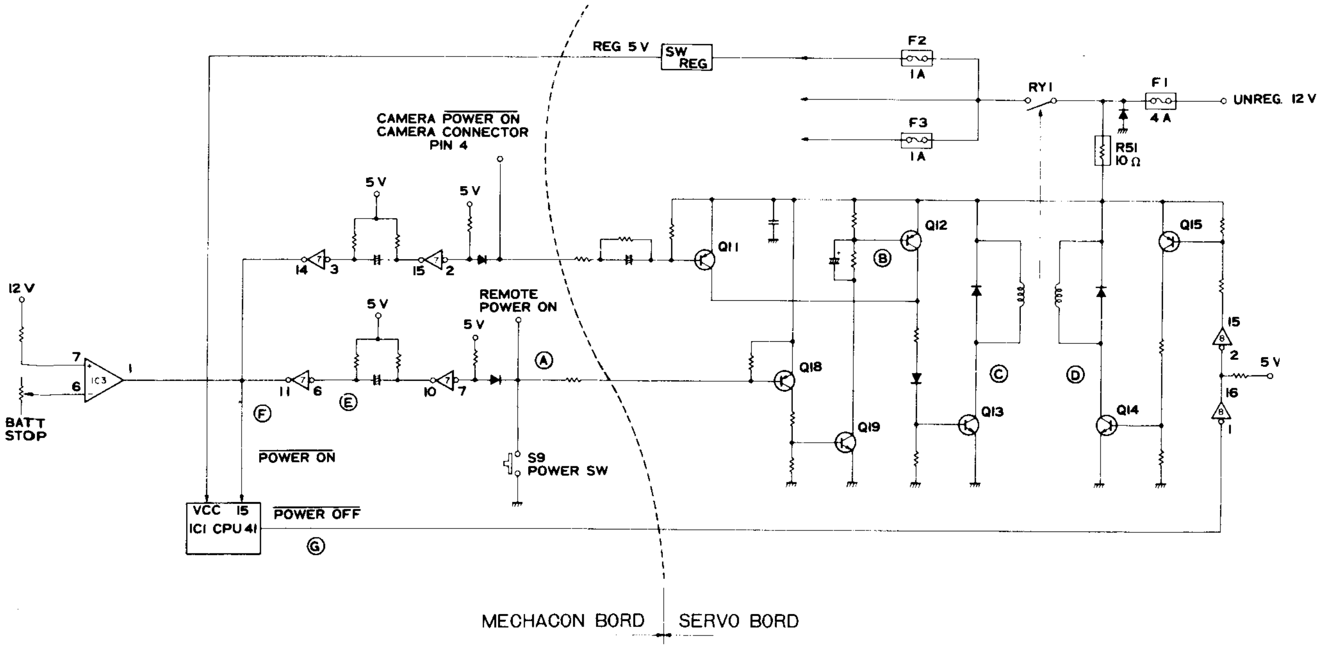


Fig. 3-6

Latching relay RY1 retains its previously driven on or off state. Consequently, if the battery power is disconnected, then reconnected, the mainframe remains in the power on mode.

(2) Power off operation

While the power is on, again pressing the POWER button initiates the power off operation. A negative pulse from IC7 pin 10 is differentiated and applied to pin 6 of IC7. The negative pulse for power off control then goes from IC7 pin 11 to IC1 pin 15. By this, the IC microprocessor detects pressing of the POWER button and, after a 100 msec delay, issues the power off command from pin 41. The delay serves for audio muting and avoid noise.

If recording or playback is in progress, unloading is first performed and the Stop mode entered. Then after 100 msec delay, the power off command is issued.

Similarly, power off from the 10-pin camera connector or remote control unit is initiated by applying the signal to IC1 pin 15.

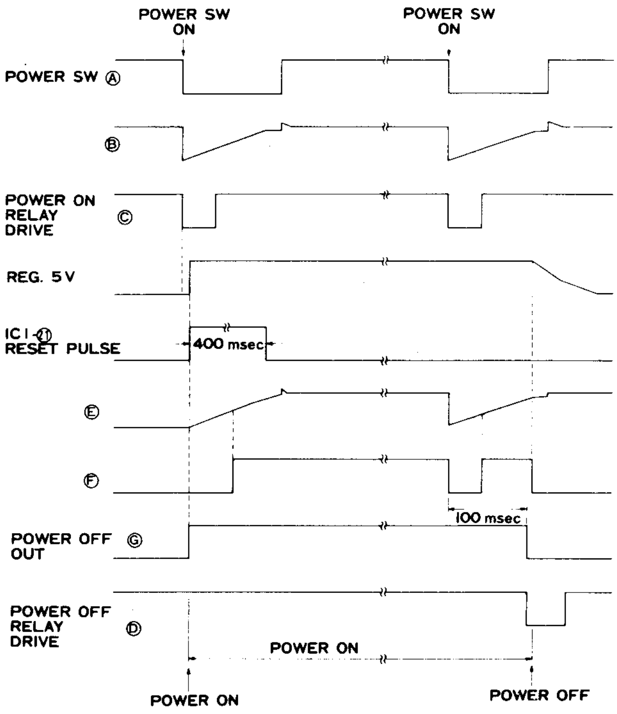


Fig. 3-7

(3) Battery depletion

During battery operation, the power off function is also triggered when the battery voltage declines below a certain value. Unregulated 12 V goes to pin 6 of IC3, which serves as a comparator for monitoring the battery voltage.

As long as the battery voltage exceeds 10.3 V, IC3 output remains at high potential. However, when the battery voltage drops below 10.3 V, the comparator output reverses to low potential. The resulting negative pulse is detected by IC1, which sends the power off command from pin 41.

2. Reset pulse generator (IC2)

The initial reset pulse for the microprocessor is generated by this circuit. At power on, regulated 5 V is divided by R79 and R81 to supply approximately 2.5 V to pin 5 of IC2. Simultaneously, IC2 pin 6 begins charging at the time constant of R78 and C7.

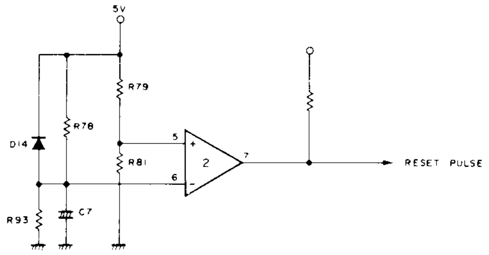


Fig. 3-8

High voltage thus appears at IC2 pin 5 at power on and the output is also high potential. After approximately 400 msec, pin 6 becomes fully charged and the output drops to low potential. The reset pulse is therefore generated for about 400 msec after power on.

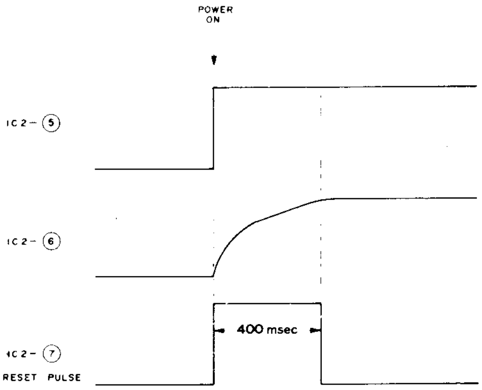


Fig. 3-9

3. Key scan circuit

Data outputs for key scan appear at IC1 pins 17 to 20. These are in the form of 4-bit BCD (binary coded decimal) data for key scan 0 to 3 and go to RA3. Resistor array RA3 operates as a digital to analog (D/A) converter and produces a 15-step DC voltage output from the 4-bit data. Each step corresponds to a variation of 0.3 V, which goes to IC3 comparator.

Operating a control button applies a DC voltage to the other input of the comparator. The output of the comparator is sent as a negative pulse with width determined by the respective control button to IC1 pin 15. By detecting the width of the pulse, the microprocessor determines which button has been pressed.

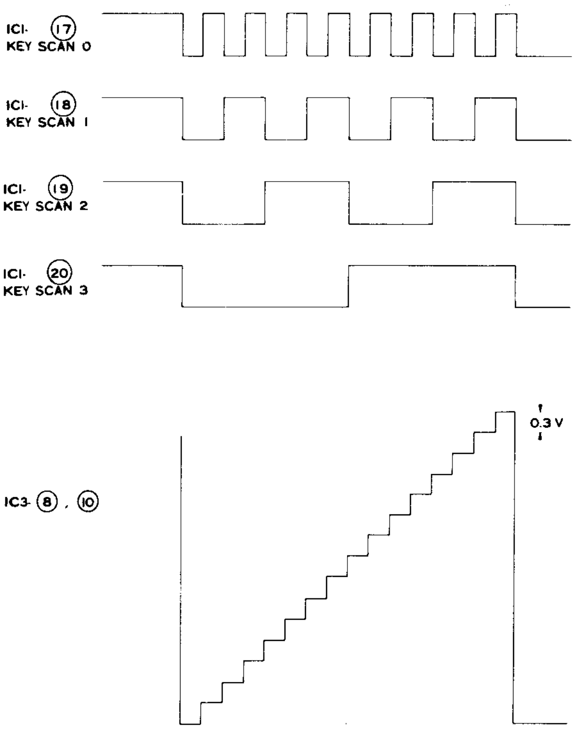


Fig. 3-10

The circuit power supply of 5 V results in a voltage change of 0.3 V per step. In order to avoid erroneous operation, the data are polled 10 times (usually 2 times with full size decks) and a selected mode is entered only after the same data are obtained 10 times. Each polling cycle requires from 2 to 5 msec, resulting in a total delay of about 60 msec, which presents no problem in practical operation.

4. Loading motor operation

   Loading motor control is obtained from pins 34 and 35 of IC1, and applied to IC301 of the servo circuit. Mechacon IC1 detects the states of the loading and unloading switches, and controls the loading motor.

(1) Loading and unloading switches

In the Stop mode, the unloading switch is on and the loading switch is off. When loading starts, the unloading switch state changes from on to off, and just prior to completion of loading, the loading switch becomes on. At this point, the mechacon circuit detects the end sensor state. Since a cassette lamp is absent, this function is performed by the tape end sensor. However, as the end sensor detects light in the Stop, FF and REW modes, this operation is defeated when tape is not loaded.

At this point, the capstan motor starts. When both loading and unloading switches are simultaneously on, the loading motor stops and the play mode is entered.

(2) REC LOCK switch

With the REC LOCK switch engaged, when power is switched off, the back space operation is performed. After the pinch roller disengages, the power becomes cutoff.

At completion of back space, the mechacon instructs reverse rotation of the loading motor in order to release the pinch roller. Reverse rotation continues until the loading switch becomes on, the rotation stops and power is cutoff. The tape remains loaded and the pinch roller released.

In this state, when power is returned, the loading switch is initially off and the loading motor rotates in the forward direction. When the pinch roller is fully engaged, the loading switch becomes on and the REC Pause mode is entered.

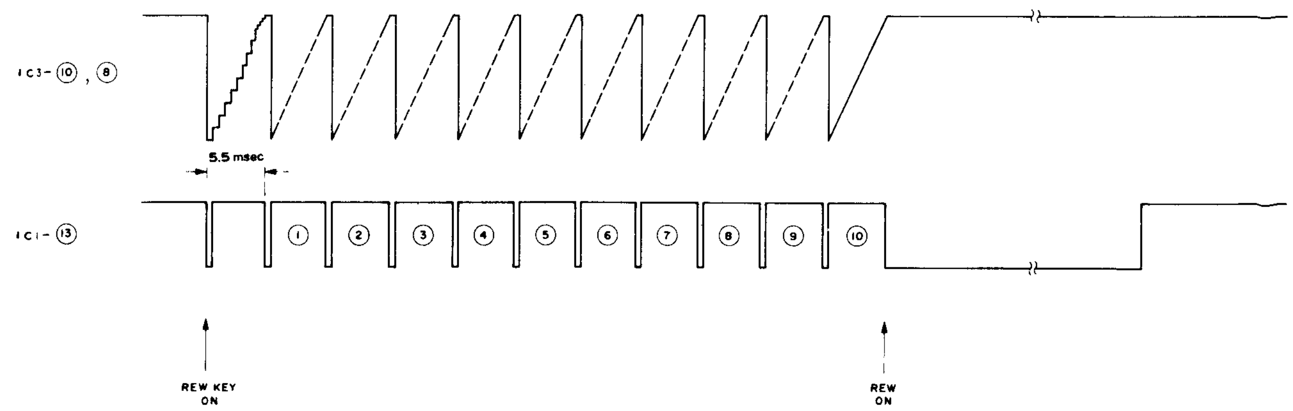
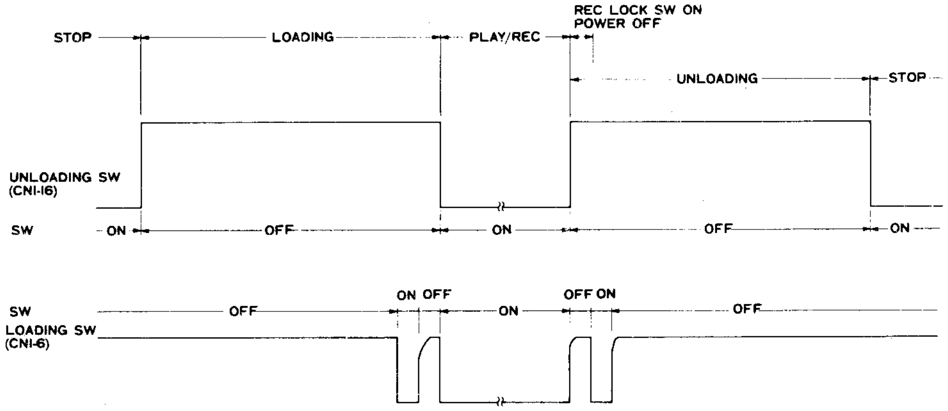


Fig. 3-11



	STOP	LOADING	LOADING END	REC LOCK ON POWER OFF
UNLOADING SW	Low	High	Low	High
LOADING SW	High	High	Low	Low

Fig. 3-12

5. Reel motor speed control

Reel motor rotation is controlled by 4-bit data from IC1 pins 28 to 31. RA1 converts the digital data to analog form, and the speed control output is supplied via the servo circuit to the switching regulator. In accordance with the 4-bit data, the voltage from RA1 is in 15 steps, resulting in 0.3 V DC per step. The approximately doubled DC voltage from the switching regulator goes to reel motor drive IC302.

In addition to speed, the forward/reverse direction signal from the mechacon circuit is also applied to IC302.

In modes other than Fast-forward and Rewind, the reel motor is controlled for a fixed speed. Setting data are supplied by the CPU for each mode. Since low voltage is supplied only in the Play mode, D19 switches on and R41 (REEL MOTOR) adjusts the voltage for play speed.

During FF and REW, the CPU monitors reel rotation and performs reel motor speed control. As indicated in Fig. 3-13, since reel rotation is slow at the start of Rewind, the CPU increases the output voltage in steps from 1 to nearly maximum at about 4.8 V. Reel motor speed increases quickly and, as the diameter of the tape remaining on the take-up reel becomes smaller, the reel rotation increases.

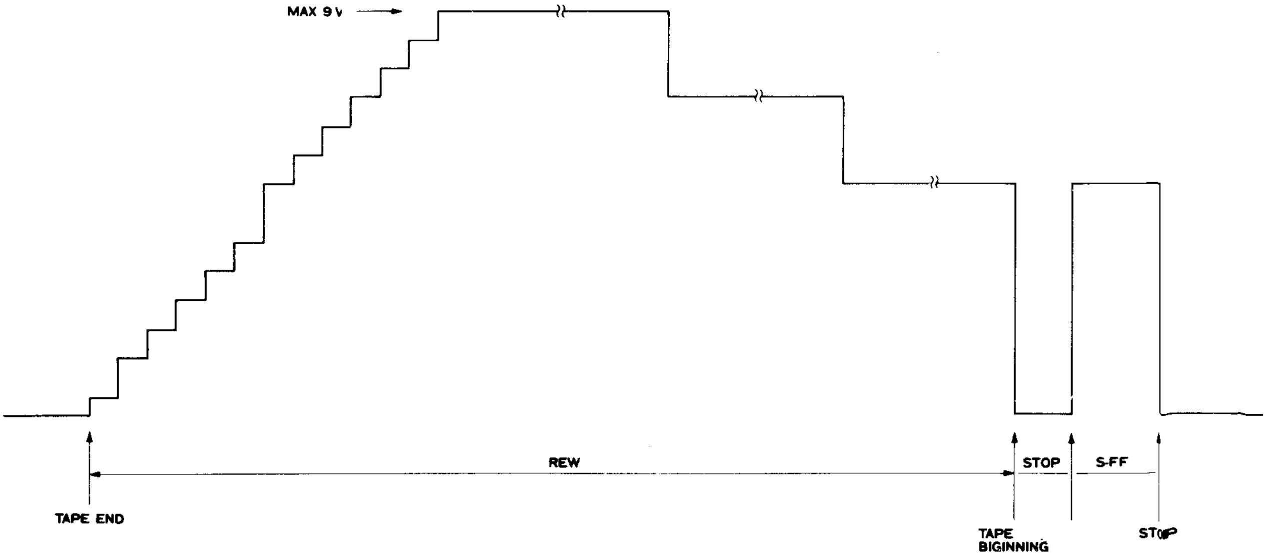


Fig. 3-13

The CPU detects the reel pulse at pins 3 and 4, and controls the rotation according to the load. As shown in Fig. 3-14, reel speed increases as the amount of tape on the take-up reel decreases during Rewind. But since the diameter of the tape on the supply reel has increased, the tape rewinding rate becomes reduced only minimally.

In absence of a cassette lamp, end of tape is detected during FF and REW by reel stoppage, upon which the Stop mode is entered. Therefore, the CPU performs a speed limiting function in order to avoid excess stress on the tape at the end of FF or REW.

During Rewind, the take-up reel pulses are counted. If the count exceeds a certain value, the command for reduced speed is issued. In the Fast Forward mode, the supply reel pulses are counted to perform control.

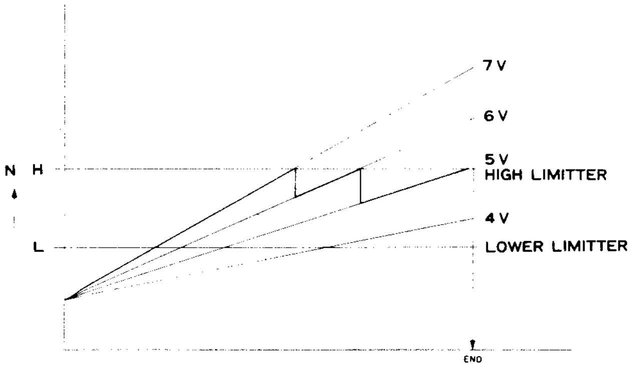


Fig. 3-14

6. Counter reset pulse generator
Capacitor C5 provides approximately 60 minutes backup. If the power is switched on while C5 is descharged, approximately 3 V goes to comparator IC4 pin 3. At the same time, a steadily rising potential (R54 and C4 time constant) is applied to IC4 pin 2.

Consequently, an approximately 50 msec positive pulse is obtained from IC4 pin 1, which functions as the counter reset pulse via Q1 and Q2.

On the other hand, if power is switched on while C5 is charged, approximately 3.5 V is supplied to IC4 pin 2 from the capacitor. This maintains the pin 2 potential higher than pin 3 and prevents the reset pulse output.

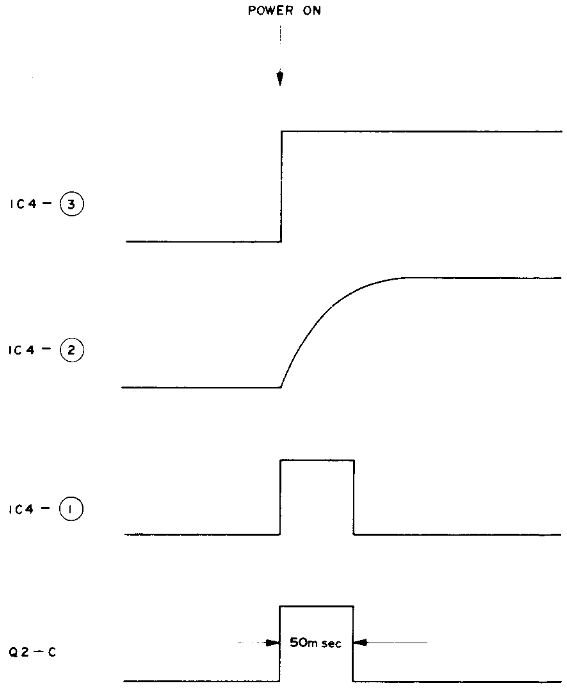


Fig. 3-16

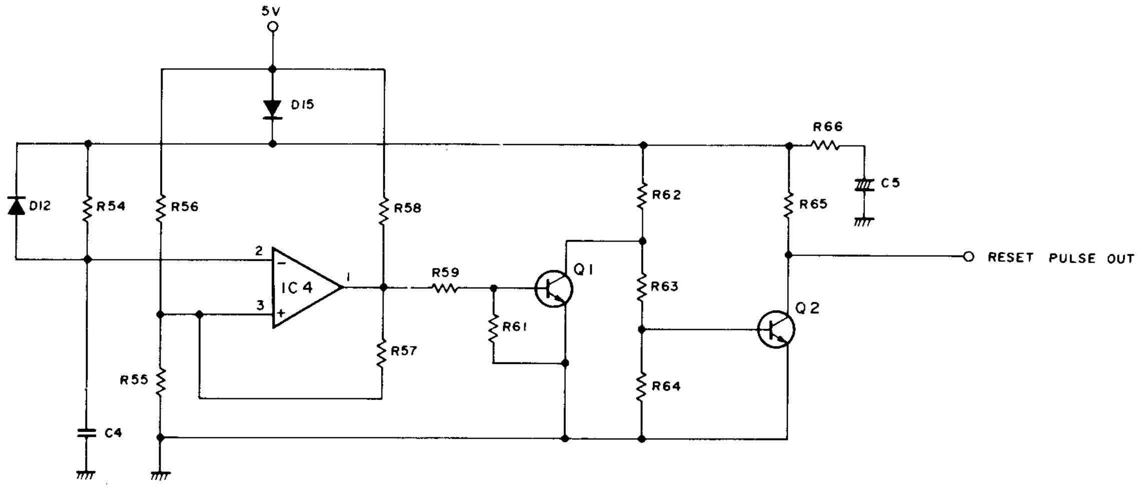


Fig. 3-15

3.1.4 Back space editing

In the Recording mode, pressing the PAUSE button stops the tape after a short over-run. This over-run (α) is stored in the microprocessor by counting the capstan FG (252 Hz) pulses. The capstan motor turns in reverse to transport the tape in reverse direction by the amount equivalent to 252 FG pulses + α. A slight over-run also occurs in reverse and this is again stored in the memory. The Pause mode is then entered.

When the PLAY button is pressed in this state, playback becomes performed for 0.9 sec + α, then the Recording mode is resumed. This results in approximately 0.1 sec overlap.

Similarly, if power is switched off with the REC LOCK switch engaged, after back-space and pinch roller release, the power becomes cutoff. When power is returned, the pinch roller engages and the Pause mode is entered. At this time, pressing the PLAY button initiates the above editing function.

With this model, the Pause mode is held for 3 seconds after back-spacing. Therefore, even though the PLAY button may be pressed during back-space, Pause continues and Recording becomes resumed three seconds later.

Since back-preview operation is performed, the servo circuit becomes set to the playback mode (crystal locked). After entering Pause, this is changed to the sync component of the input video signal. The Mecha-con CPU therefore holds the Pause mode for 3 seconds in order to allow time for drum servo synchronization.

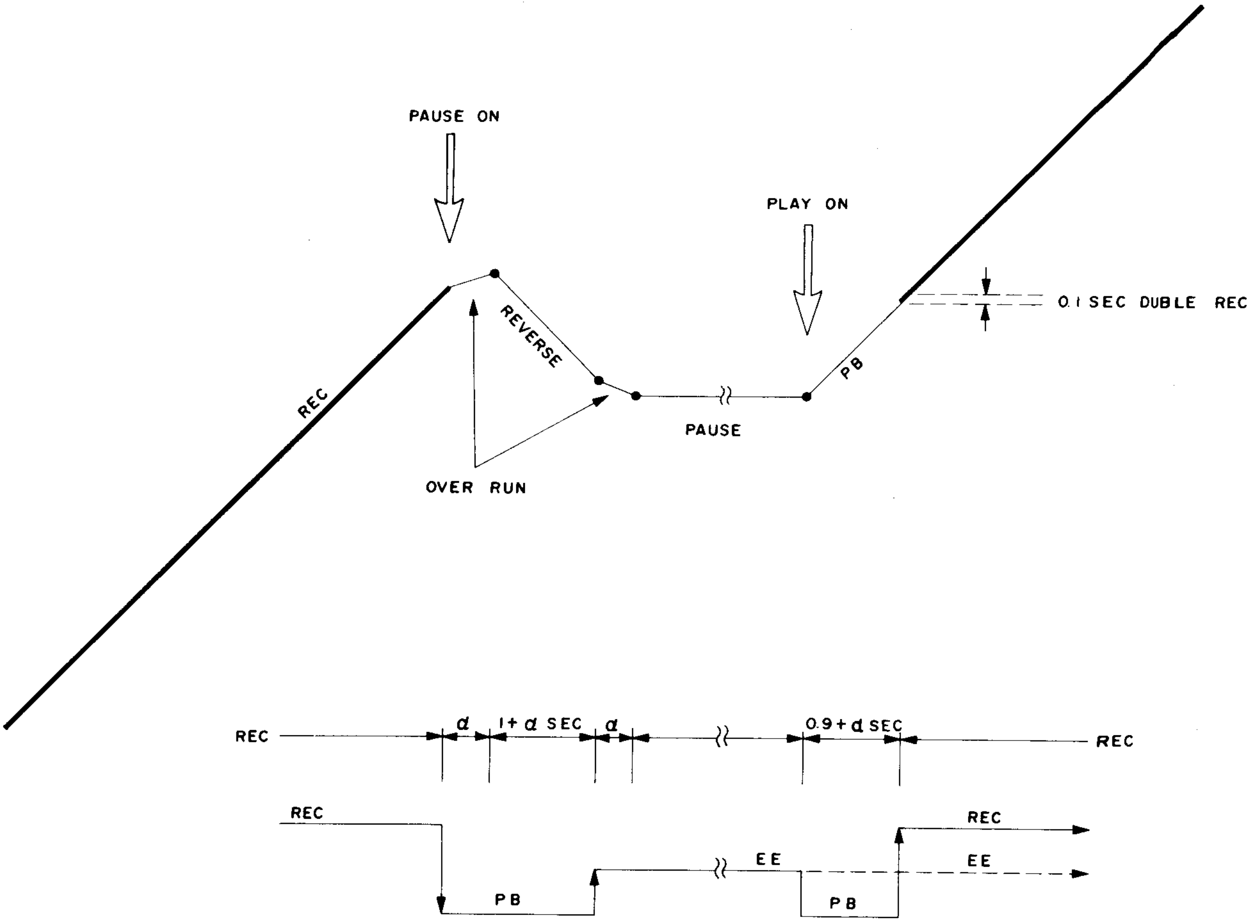


Fig. 3-17

3.1.5 Mechacon operation checkpoints

1. Observe that power on is correctly performed from the POWER switches of the mainframe, remote control unit and camera control. After power on, the STOP LED lights and auto-rewind is performed for 0.2 sec in order to avoid tape slack. At this time, the video output signal is E-E.
2. When a cassette is loaded into the cassette housing, the cassette switch becomes on and auto-rewind is performed for approx. 0.2 second.
   Operation is inhibited when the cassette switch is off.
3. At the beginning of the tape in the Rewind mode, The Stop mode is entered. Conversely, at the end of the tape during FF, Rewind is performed for 1 second.

   During aute REW, the REW LED flashes, and only the Rewing command can be entered.

   FF and REW can be switched directly, but the Stop mode is entered for 0.5 sec between tape direction changes.
4. From the Stop mode, when the Play mode is selected, the E-E mode is entered during loading. The Play mode becomes selected one second after completion of loading.
5. At the end of tape during Play. the Stop mode is entered. After completion of unloading, auto rewind is performed to the beginning of the tape.
6. The Play mode can be entered from Stop, REW, FF or unloading. From FF or REW, the Stop mode is entered for 0.5 sec before switching to Play.
7. In order to avoid accidental erasure, the PLAY button operation is inhibited while the REC LOCK switch is on.
8. During Play, pressing the FF or REW button yields the Search mode. When alternating between Play and Search, the Pause mode is entered for 0.5 sec between transitions.
9. If end of tape is detected in the Search mode, the Pause mode becomes entered.
10. Both REC and PLAY LEDs light during loading. At completion of loading, when the Recording mode is entered, the REC LED begins flashing at approximately 1 Hz.

    The REC LED lights continuously during Pause and back-space.

    At 1 minute before end of tape, the REC indication is modulated at 10 Hz during its 1 Hz period.
11. When the PAUSE button is pressed during recording, the capstan turns in reverse to rewind a one second portion of the tape. During this interval, both REC and PLAY LEDs light and the PAUSE LED flashes. The video and audio circuits are switched to the playback mode (back review).

    In the Pause mode, the PAUSE LED lights steadily and the video output is E-E.
12. During the return from the Pause to the Recording mode, the PAUSE LED extinguishes and recording resumes after 0.9 sec. The overlap portion is 2 to 3 frames. Recording start is synchronized to the drum flip-flop signal.
13. Power off operation is initiated either manually by switch selection, or automatically by low battery voltage detection. When this occurs during recording with the REC LOCK switch ON, back space is performed and the Pause mode entered. A short unloading operation disengages the pinch roller (unloading switch off and loading switch on), then the power becomes cutoff.
14. By returning power in the REC LOCK Pause state, a short loading operation is performed to re-engage the pinch roller, then the Recording mode is resumed.
15. The STOP LED flashed during unloading. If the FF or REW button is pressed during unloading, the respective LED flashes and the memory becomes set.
16. When the Stop mode is entered after unloading, FF or REW, auto rewind is performed for 0.2 sec. During this interval, all operations are inhibited.
17. Remaining tape time indication is provided during Play and Recording modes. While the remaining time is greater than five minutes, the display is in minutes (seconds indication remains at 00) with a flashing colon (about 1 Hz). At less than five minutes, both minutes and seconds indications decrement.

3.1.6 Auto stop operation

1. If the loading operation continues for more than 10 seconds, the auto stop operation becomes initiated. Unloading is performed and the Emergency mode entered.
2. Auto stop is triggered if the cassette switch becomes off during operation.
3. Dew detection initiates auto stop.
4. If the record safety switch becomes off during recording, the Stop mode is entered, and Recording and Audio Dub are inhibited.
5. Battery voltage decline to 10.3 ± 0.2 V triggers the auto stop and the power becomes cutoff.
6. Continuous operation of the Pause or Still mode triggers the auto stop operation. Unloading is performed and the power cutoff.
7. Continuation of the REC LOCK Pause mode for more than 5 minutes initiates auto stop. In this case, power becomes cutoff, but tape remins loaded.
8. If unloading continues for more than 10 seconds, the Emergency mode is entered.
9. With the POWE SAVE switch ON, continuation of the Stop mode for more than 5 minutes initiates auto power off.

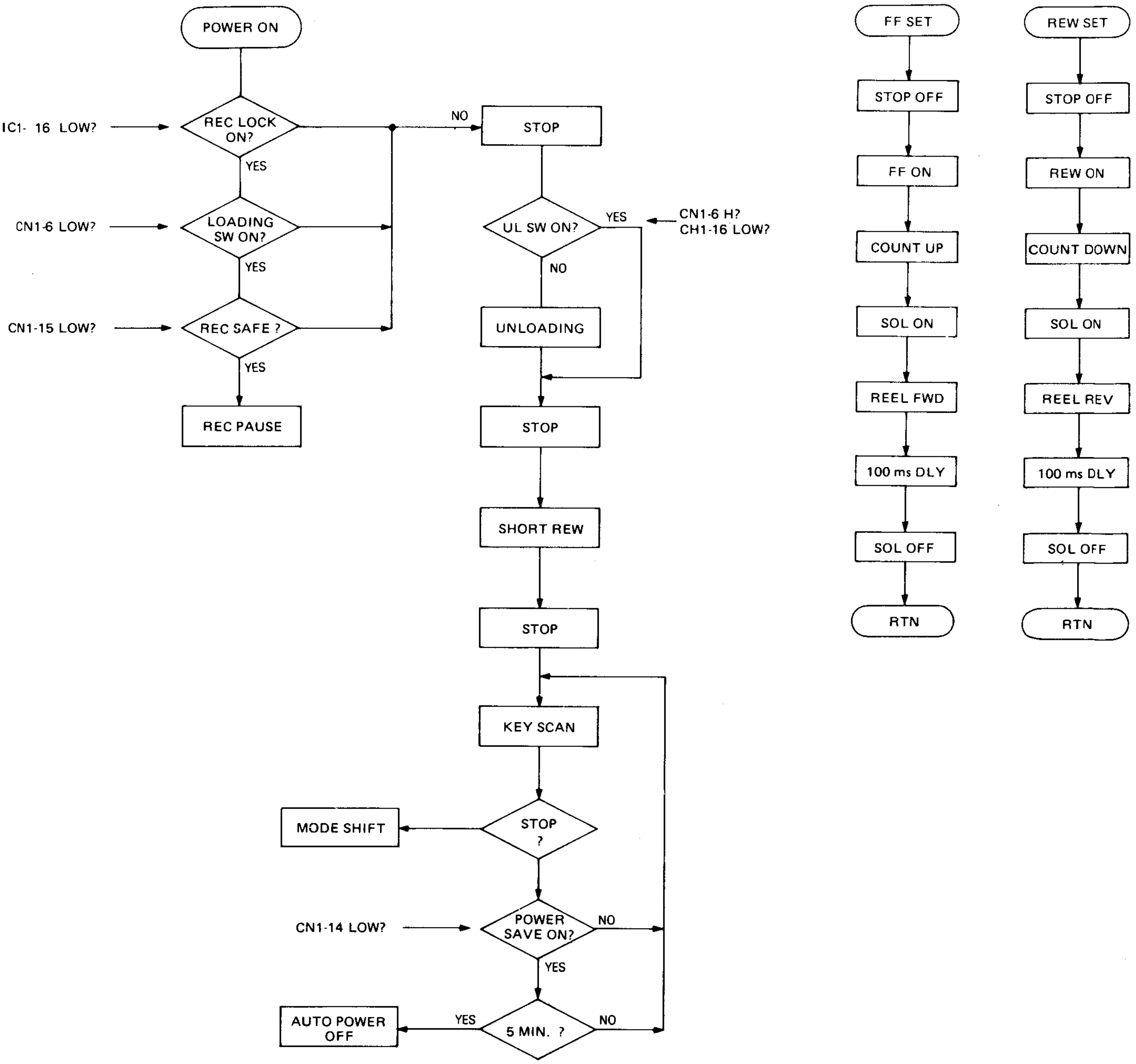
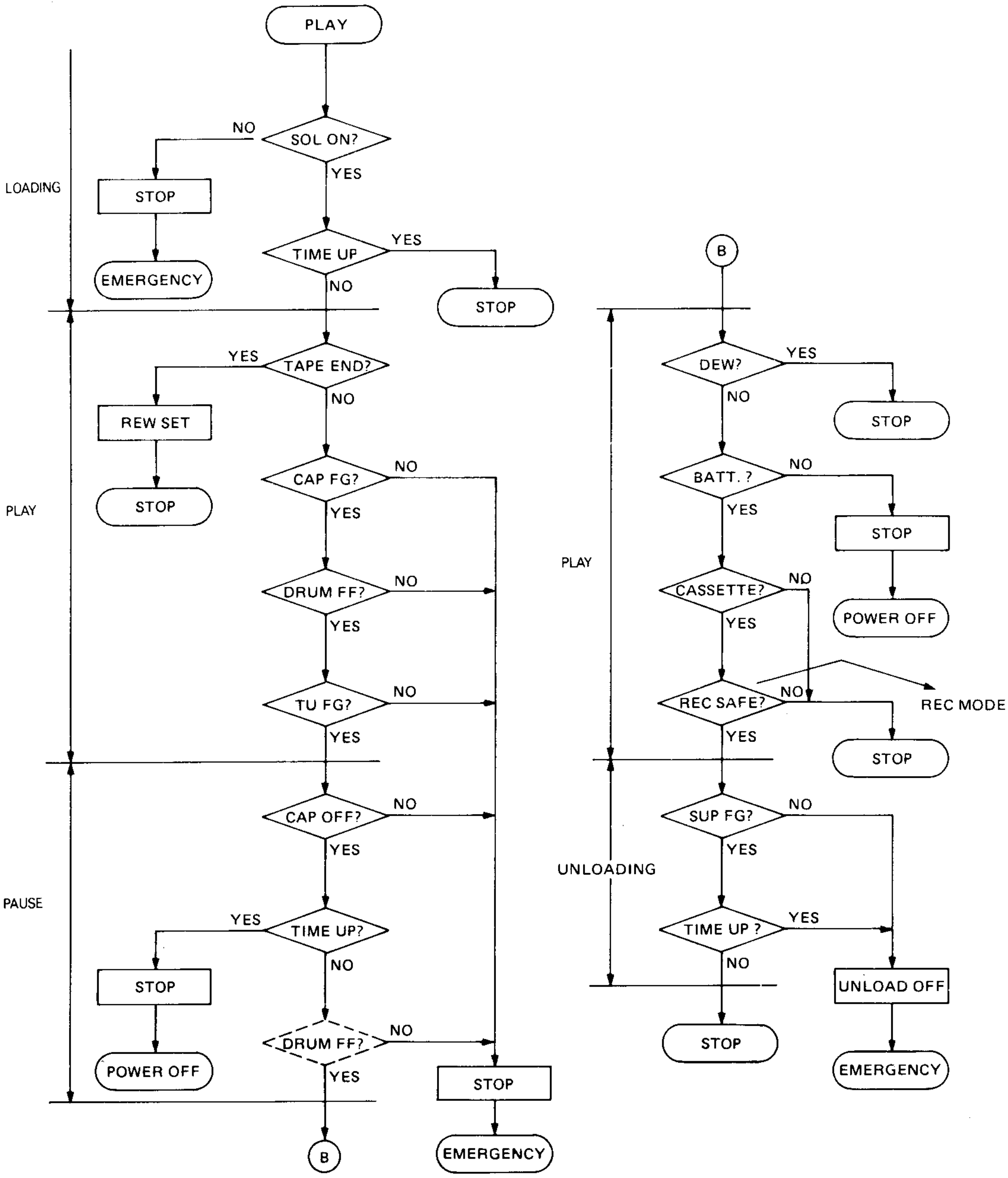

POWER ON
IC1- 16 LOW?
REC LOCK ON?
NO
STOP
YES
CN1-6 LOW?
LOADING SW ON?
UL SW ON?
YES
CN1-6 H?
CH1-16 LOW?
YES
NO
CN1-15 LOW?
REC SAFE ?
UNLOADING
YES
REC PAUSE
STOP
SHORT REW
STOP
KEY SCAN
MODE SHIFT
STOP ?
CN1-14 LOW?
POWER SAVE ON?
NO
YES
AUTO POWER OFF
YES
5 MIN. ?
NO
FF SET
STOP OFF
FF ON
COUNT UP
SOL ON
REEL FWD
100 ms DLY
SOL OFF
RTN
REW SET
STOP OFF
REW ON
COUNT DOWN
SOL ON
REEL REV
100 ms DLY
SOL OFF
RTN

Fig. 3-18

10. Continuation of the Emergency mode for more than 2.5 minutes initiates auto power off.

The Emergency mode is activated in the following situations.

1) Solenoid switch does not close after IC1 issues the solenoid drive pulse.
2) Capstan FG pulse absent in modes when the capstan should be rotating.
3) Drum flip-flop pulse absent in modes when the capstan should be rotating.
4) Take-up reel disk rotation stops during tape transport.
5) Capstan motor continues to turn in the Pause mode.
6) Supply reel disk rotation stops during unloading.
7) Loading or unloading continues for longer than 10 seconds.



PLAY
LOADING
NO
SOL ON?
YES
STOP
EMERGENCY
TIME UP
YES
NO
STOP
PLAY
YES
TAPE END?
NO
REW SET
STOP
CAP FG?
NO
YES
DRUM FF?
NO
YES
TU FG?
NO
YES
PAUSE
CAP OFF?
NO
YES
TIME UP?
YES
NO
STOP
POWER OFF
DRUM FF?
NO
YES
STOP
EMERGENCY
B
B
PLAY
DEW?
YES
NO
STOP
BATT. ?
NO
YES
STOP
POWER OFF
CASSETTE?
NO
YES
REC SAFE?
NO
YES
REC MODE
STOP
UNLOADING
SUP FG?
NO
YES
TIME UP ?
YES
NO
STOP
UNLOAD OFF
EMERGENCY

Fig. 3-19

3.1.7 Tape counter (LC4052)

1. 4-Digit UP/DOWN Counter Operation
   1) When UP/DOWN is L, count-up is performed with SUP FG falling. When UP/DOWN is H, count-down is performed with SUP FG rising.
   2) Counter indication is in 4 digits form 0000–9999. After 9999, 0000 is displayed again.
   3) POWER ON RST and RST during counter indication cause reset to 0.
   4) While RST input continues, counter reading is kept at 0.

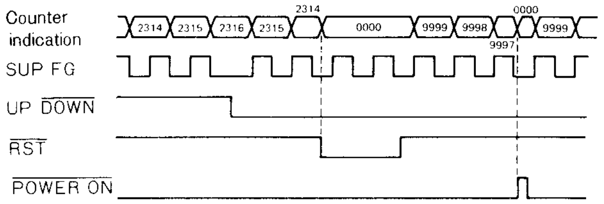

Counter indication
2314
2315
2316
2315
2314
0000
9999
9998
9997
0000
9999
SUP FG
UP DOWN
RST
POWER ON

Fig. 3-20

2. Zero-Memory Output Operation
   1) With the Memory is set to ON, a zero-output pulse of appr. 100 msec is produced when the counter passes 0000.
   2) When PLAY is L, no output is produced.
   3) Also after producing the zero-output, the Memory ON-OFF condiction does not change.

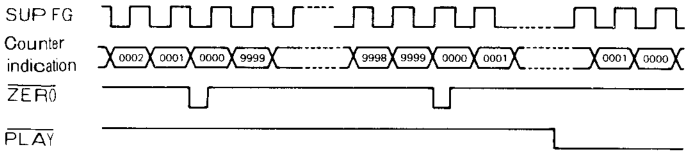

SUP FG
Counter indication
0002
0001
0000
9999
9998
9999
0000
0001
0001
0000
ZERO
PLAY

Fig. 3-21

3. Tape-Run Output Operation
   1) When PLAY is L, an output pulse of appr. 400 msec is produced with SUP FG falling.
   2) When the result of remaining time calculation is less than 1 minute, 10 Hz flashing output is produced.
   3) When PLAY is H, with every 2 SUP FG pulses, the RUN output ON-OFF is repeated, and the last pulse only is 400 msec.

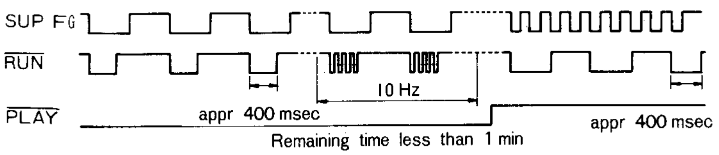

SUP FG
RUN
10 Hz
PLAY
appr 400 msec
Remaining time less than 1 min
appr 400 msec

Fig. 3-22

4. Remaining Time Indication
   1) When PLAY changes from H to L, after the lapse of a fixed time interval, remaining tape time is calculated.
   2) When PLAY has changed from H to L and remaining tape time indication is to be performed, a (–) bar indication is synchronized with the SUP FG, and after a fixed time interval, remaining tape time is indicated.
   3) After PLAY has changed to L, the time required until remaining tape time is indicated is as follows:
      When the result of remaining tape time calculation is
      500 seconds or more ..... 5 sec + (SUP FG 5–6 pulses)
      When the result of remaining tape time calsulation is
      less than 500 seconds ...... 5 sec + (SUP FG 8–9 pulses)
   4) When PLAY changes from L to H, a compulsory change to counter indication is effected, and the remaining tape time is cleared.
   5) When during remaining tape time calcultation for fixed interval of S seconds no SUP FG input is present, the Pause mode is assumed as having been entered, and the operation for remaining tape time calculation is interrupted. When SUP FG input is detected again, the Pause mode is presumed released, and calculation operation resumed.

Tape speed	NTSC standard	NTSC × 1/2	NTSC × 1/3	PAL
S (Second)	2	4	6	3

   6) When the remaining tape time is 5 minutes or more, the seconds are 00, and only minutes are displayed. When the remaining tape time is less than 5 minutes, minutes and seconds are displayed.

7:00 ➡ 6:00 ➡ 5:00 ➡ 4:59 ➡ 4:58 ➡ 0:00

   7) For the second indication in remaining tape time, constant compensation is performed, and for 0.8–1.2 seconds 1 second is subtracted.
   8) When the remaining time indication is 5 minutes or more, the colon flashes in synchronization with SUP FG.
   9) When the remaining tape time indication has become 0:00, this indication is maintained.

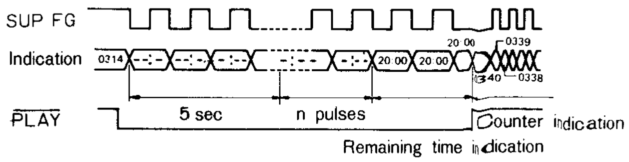

SUP FG
Indication
0314
20 00
20 00
20 00
0339
0340
0338
PLAY
5 sec
n pulses
Counter indication
Remaining time indication

Fig. 3-23

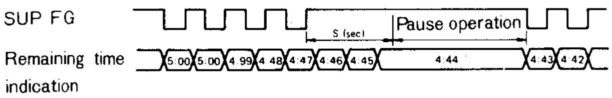

SUP FG
S (sec)
Pause operation
Remaining time indication
5:00
5:00
4.99
4 48
4:47
4:46
4:45
4:44
4:43
4:42

Fig. 3-24

- Suitable tape – TC-20

Tape length	43.7^{+2}_{0} 〔m〕
Tape thickness	19^{+1}_{-2} 〔μm〕
Leader tape	80±5 〔mm〕
Trailer tape	110±5 〔mm〕
Reel hub diameter	26±0.1〔mm〕

- Tape speed

MODE	Tape speed
NTSC Standard	33.35 〔mm/sec〕
NTSC 1/2 Speed	33.35×1/2 〔mm/sec〕
NTSC 1/3 Speed	33.35×1/3 〔mm/sec〕
PAL Mode	23.39 〔mm/sec〕

5. Key input operation

(1) RST key

1) RST resets the counter reading to zero.
2) During RST input, counter indication remains at zero.
3) When the counter is reset to zero by pressing the RST key, zero-output is not produced.
4) During remaining time indication, the RST key is inactive.

Refer to the timing chart in Fig. 3-19.

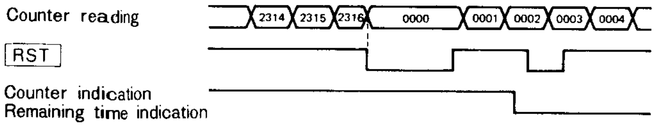

Counter reading
2314
2315
2316
0000
0001
0002
0003
0004
RST
Counter indication
Remaining time indication

Fig. 3-25

(2) MEMORY key

1) The MEMORY key switches the memory mode ON or OFF.
2) During remaining time indication, the MEMORY key is inactive.
3) During counter indication, when the memory is set to ON, the letter "M" is displayed.

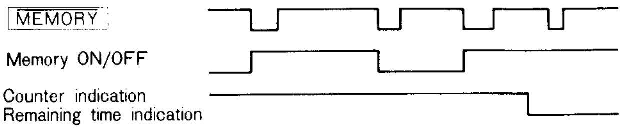

MEMORY
Memory ON/OFF
Counter indication
Remaining time indication

Fig. 3-26

(3) COUNTER/REMAINING key

1) This key serves to switch between counter indication and remaining tape time indication.
2) When PLAY is H, counter indication is displayed and this key is inactive.

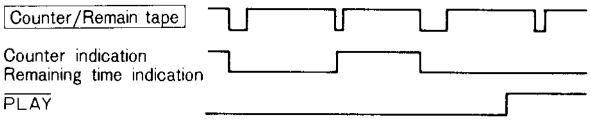

Counter/Remain tape
Counter indication
Remaining time indication
$\overline{\text{PLAY}}$

Fig. 3-27

6. Input/Output terminal operation

(1) POWER ON RST input

1) POWER ON RST rising initializes all functions: counter zero-reset, remaining time clear, memory OFF.
2) POWER ON RST pulse width is minimum 10 (μsec). Refer to the timing chart in Fig. 3-20.

(2) $\overline{\text{RST}}$ input

1) $\overline{\text{RST}}$ falling causes counter zero-reset.
2) During $\overline{\text{RST}}$ input, zero-reset is maintained.
3) Incorporates a chattering prevention circuit.
   T_{RST} is minimum 400 (msec).
   T_{DRST} is maximum 200 (msec).

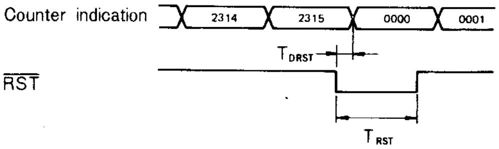

Counter indication
2314
2315
0000
0001
T_{DRST}
$\overline{\text{RST}}$
T_{RST}

Fig. 3-28

(3) $\overline{\text{PLAY}}$ input

1) When $\overline{\text{PLAY}}$ is L, remaining time calculation operation is performed.
2) When $\overline{\text{PLAY}}$ is H, remaining time calculation is cleared.

(4) $\overline{\text{STAND-BY}}$ input

1) When $\overline{\text{STAND-BY}}$ is L, the Stand-by mode is entered and the indication disappears.
2) When $\overline{\text{STAND-BY}}$ is H, during rise-up the Stand-by mode is released.
3) When $\overline{\text{STAND-BY}}$ is L, the remaining time calculation is cleared.
4) When $\overline{\text{STAND-BY}}$ is H, the counter reading is maintained.

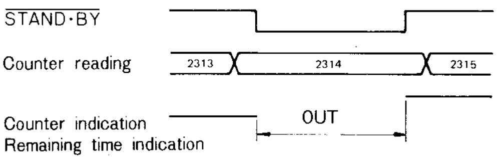

STAND·BY
Counter reading
2313
2314
2315
Counter indication
Remaining time indication
OUT

Fig. 3-29

(5) UP/$\overline{\text{DOWN}}$ input

At H, UP/$\overline{\text{DOWN}}$ performs count-up and at L count-down operation.

Refer to the timing chart in paragraph 5.3.

(6) SUP FG input

1) Input signal of 3 pulses for each turn of the supply reel.
2) With SUP FG falling, count-up is performed, and with SUP FG rising, count-down is performed, based on UP/$\overline{\text{DOWN}}$.
3) SUP FG input frequency is as follows:

	MIN	MAX
When $\overline{\text{PLAY}}$ is H.	D C	100 Hz
When $\overline{\text{PLAY}}$ is L.	D C	30 Hz

(with 50 % duty)

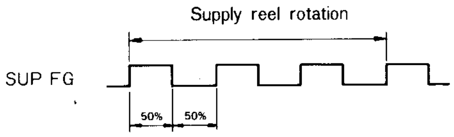

Supply reel rotation
SUP FG
50%
50%

Fig. 3-30

(7) PAL/NTSC, MODE 2, MODE 3 input

1) Selects the tape speed as shown in the chart below.

PAL/ $\overline{\text{NTSC}}$	MODE 2	MODE 3	Selected tape speed
H	X	X	PAL
L	H	X	NTSC 1/2 speed
L	L	H	NTSC 1/3 speed
L	L	L	NTSC Standard speed

X signifies either H or L.

2) If the tape speed is changed during remaining time calculation operation, the present calculation is cleared and renewed calculation starts.

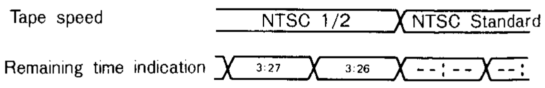

Tape speed
NTSC 1/2
NTSC Standard
Remaining time indication
3:27
3:26
- - : - -
- - :

Fig. 3-31

(8) $\overline{\text{RUN}}$ output

Feeds out a tape-run output in synchronization with the SUP FG.

Refer to Fig. 3-22.

(9) $\overline{\text{ZERO}}$ output

When $\overline{\text{PLAY}}$ is H and the memory is ON, the counter produces a zero-memory output at 0000. Delay time T_{ZD} is max. 10 (msec), pulse width T_{ZD} is approx. 100 (msec), min. 90 (msec).

Refer to FIg. 3-21.

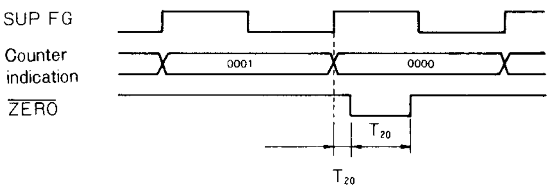

SUP FG
Counter indication
0001
0000
ZERO
T20
T20

Fig. 3-32

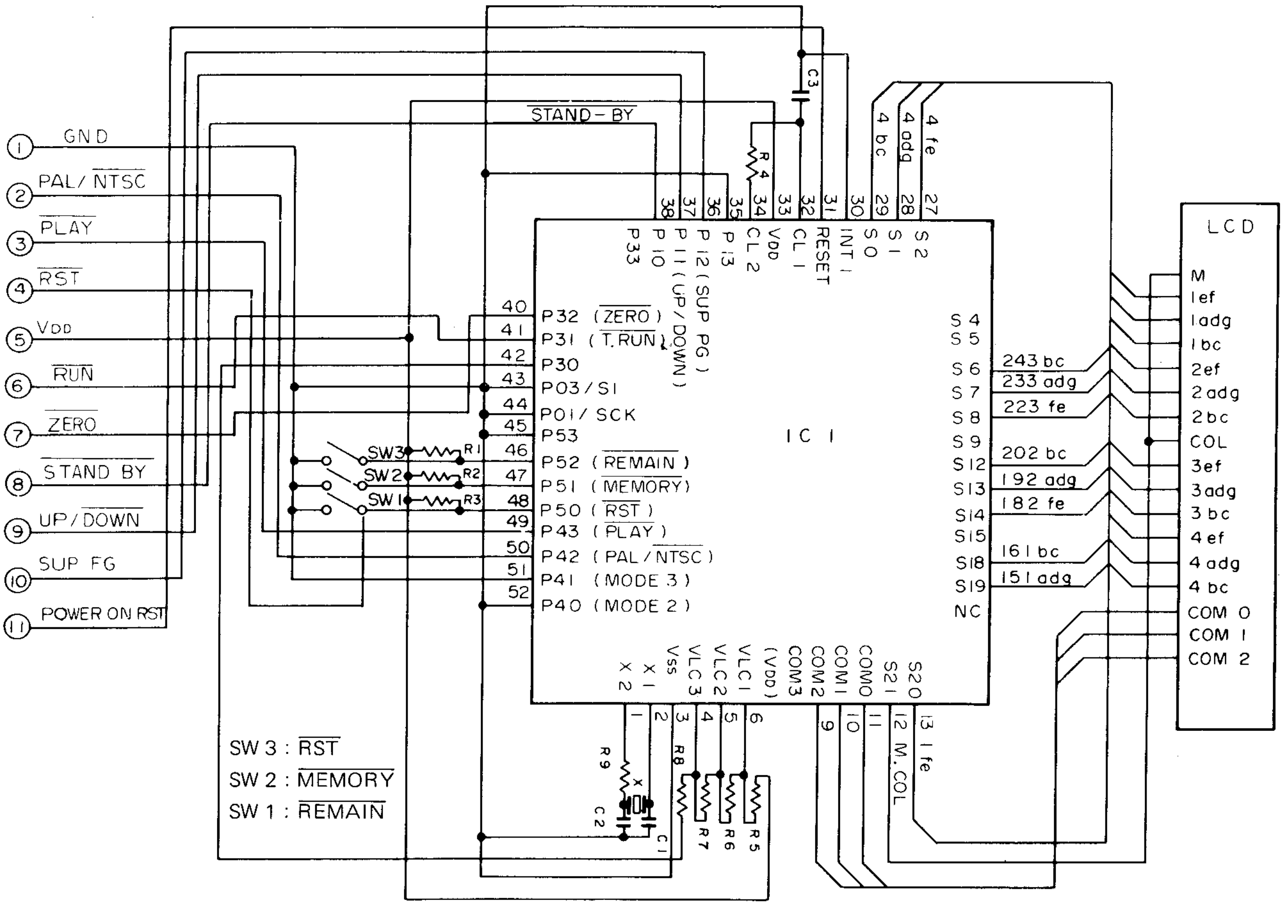

① GND
② PAL/NTSC
③ PLAY
④ RST
⑤ VDD
⑥ RUN
⑦ ZERO
⑧ STAND BY
⑨ UP/DOWN
⑩ SUP FG
⑪ POWER ON RST
STAND-BY
C3
R4
4 bc
4 adg
4 fe
38 P33
37 P10
36 P11 (UP/DOWN)
35 P12 (SUP PG)
34 P13
33 CL2
32 VDD
31 CL1
30 RESET
29 INT1
28 S0
27 S1
S2
40 P32 (ZERO)
41 P31 (T.RUN)
42 P30
43 P03/SI
44 P01/SCK
45 P53
46 P52 (REMAIN)
47 P51 (MEMORY)
48 P50 (RST)
49 P43 (PLAY)
50 P42 (PAL/NTSC)
51 P41 (MODE 3)
52 P40 (MODE 2)
SW3
SW2
SW1
R1
R2
R3
IC 1
S4
S5
S6
S7
S8
S9
S12
S13
S14
S15
S18
S19
NC
243 bc
233 adg
223 fe
202 bc
192 adg
182 fe
161 bc
151 adg
LCD
M
1ef
1adg
1bc
2ef
2adg
2bc
COL
3ef
3adg
3bc
4ef
4adg
4bc
COM 0
COM 1
COM 2
1 X2
2 X1
3 VSS
4 VLC3
5 VLC2
6 VLC1
(VDD)
COM3
9 COM2
10 COM1
11 COM0
12 S21 M.COL
13 S20 1 fe
R9
X
C2
C1
R8
R7
R6
R5
SW 3 : RST
SW 2 : MEMORY
SW 1 : REMAIN

Fig. 3-33 IC1 circuit

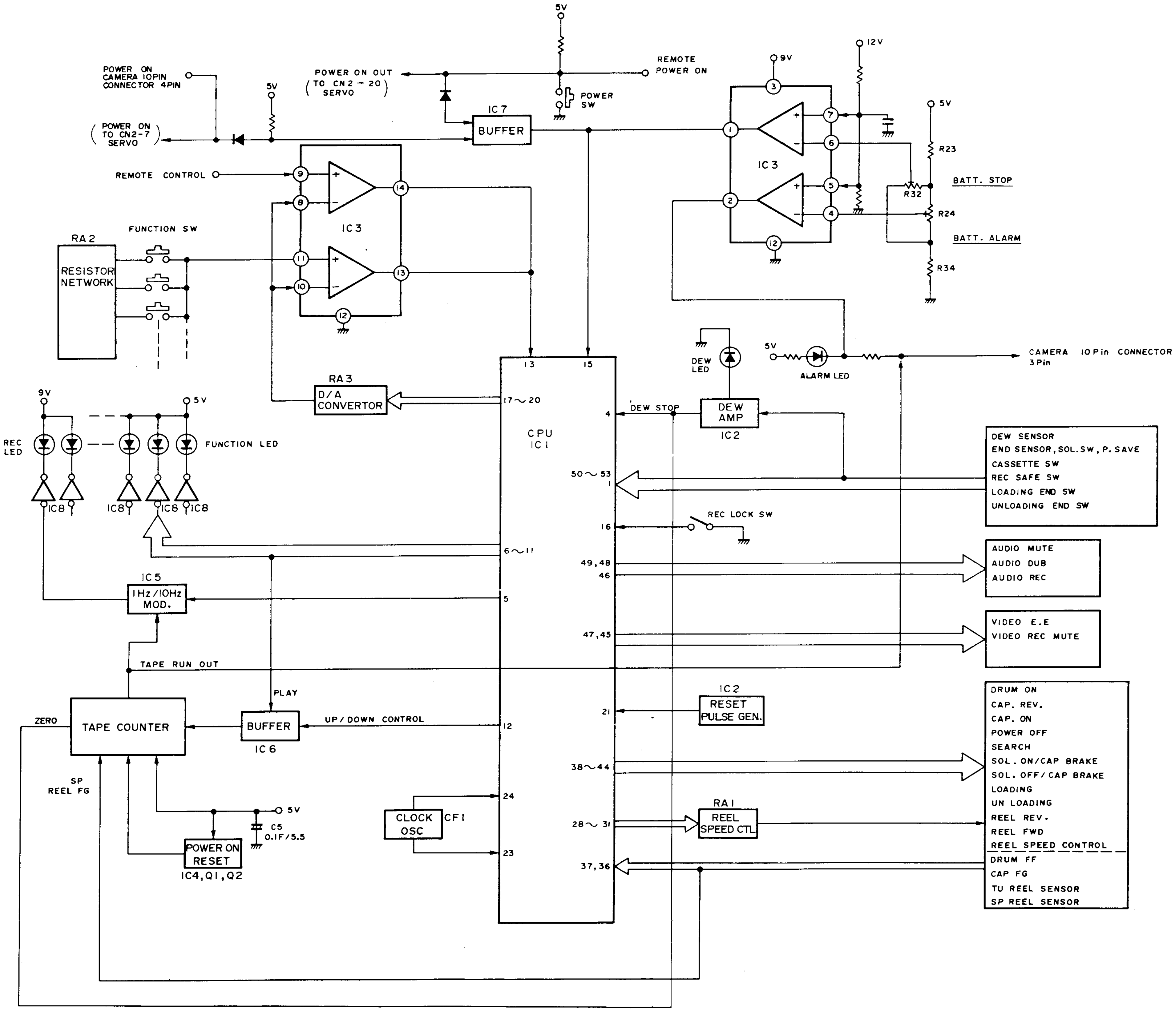

5V
REMOTE POWER ON
POWER SW
12V
9V
POWER ON CAMERA 10PIN CONNECTOR 4PIN
POWER ON OUT (TO CN2－20 SERVO)
5V
IC7
BUFFER
(POWER ON TO CN2-7 SERVO)
REMOTE CONTROL
IC3
5V
R23
BATT. STOP
R32
R24
BATT. ALARM
R34
FUNCTION SW
RA2
RESISTOR NETWORK
13
15
DEW LED
5V
ALARM LED
CAMERA 10Pin CONNECTOR 3Pin
RA3
D/A CONVERTOR
17～20
DEW STOP
DEW AMP
IC2
9V
5V
REC LED
FUNCTION LED
CPU IC1
4
50～53
1
DEW SENSOR
END SENSOR, SOL.SW, P.SAVE
CASSETTE SW
REC SAFE SW
LOADING END SW
UNLOADING END SW
IC8
REC LOCK SW
16
6～11
49,48
46
AUDIO MUTE
AUDIO DUB
AUDIO REC
IC5
1Hz/10Hz MOD.
5
47,45
VIDEO E.E
VIDEO REC MUTE
TAPE RUN OUT
PLAY
IC2
RESET PULSE GEN.
21
ZERO
TAPE COUNTER
BUFFER
IC6
UP/DOWN CONTROL
12
DRUM ON
CAP. REV.
CAP. ON
POWER OFF
SEARCH
SOL. ON/CAP BRAKE
SOL. OFF/CAP BRAKE
LOADING
UN LOADING
REEL REV.
REEL FWD
REEL SPEED CONTROL
38～44
SP REEL FG
24
CLOCK OSC
CF1
5V
C5 0.1F/5.5
RA1
REEL SPEED CTL
28～31
POWER ON RESET
IC4, Q1, Q2
23
37,36
DRUM FF
CAP FG
TU REEL SENSOR
SP REEL SENSOR

Fig. 3-34 Mechanism control block diagram

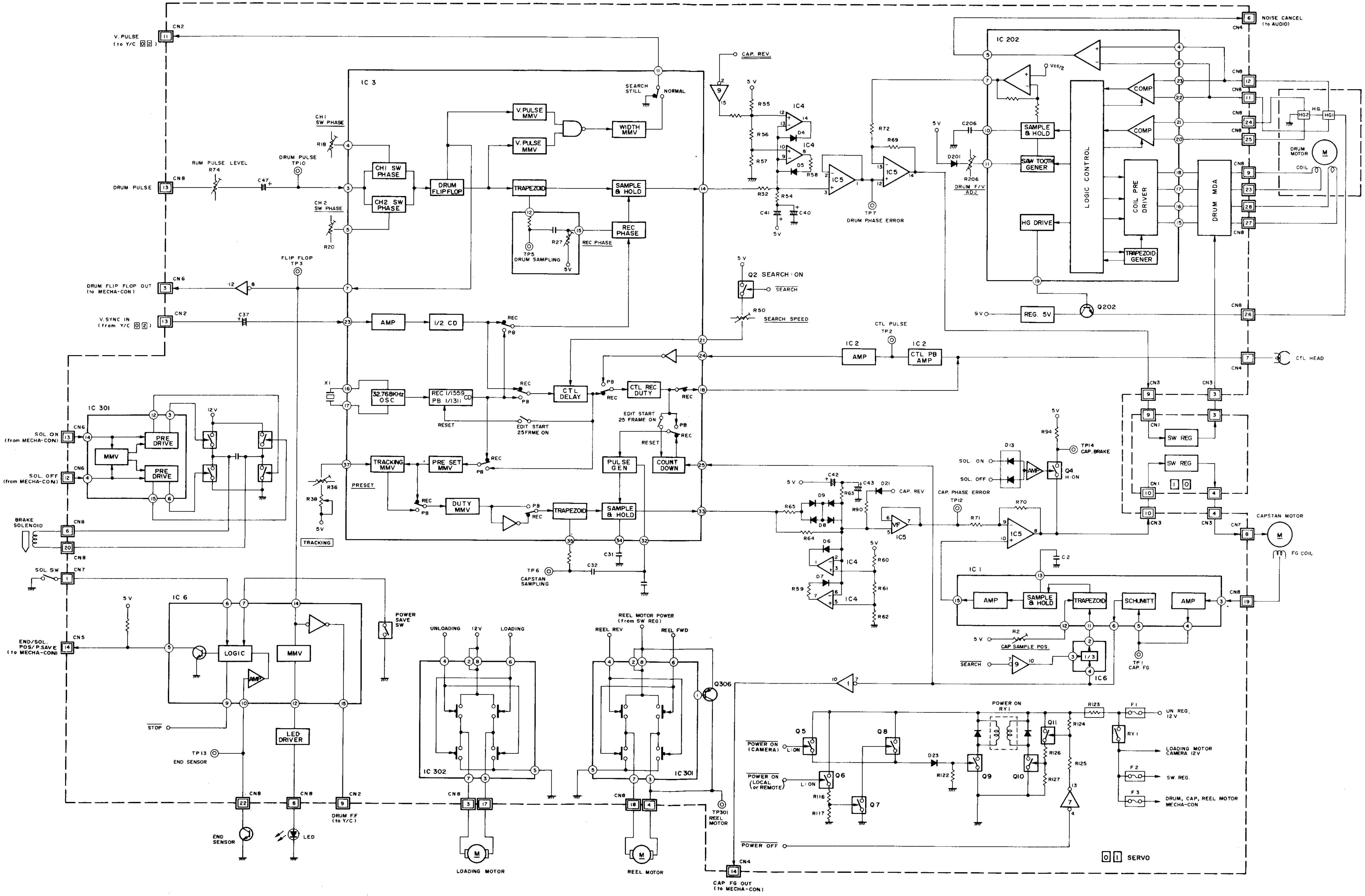

V. PULSE (to Y/C 02)
CN2
IC 3
SEARCH STILL
NORMAL
CH1 SW PHASE
R18
V. PULSE MMV
WIDTH MMV
RUM PULSE LEVEL
R74
DRUM PULSE TP10
DRUM PULSE
CN8
C47
CH1 SW PHASE
CH2 SW PHASE
DRUM FLIPFLOP
TRAPEZOID
SAMPLE & HOLD
REC PHASE
CH 2 SW PHASE
R20
R27
REC PHASE
TP5 DRUM SAMPLING
5V
FLIP FLOP TP3
DRUM FLIP FLOP OUT (to MECHA-CON)
CN6
V.SYNC IN (from Y/C 02)
C37
AMP
1/2 CD
REC
PB
X1
32.768KHz OSC
REC 1/1559 PB 1/1311
CD
RESET
EDIT START 25FRME ON
CTL DELAY
CTL REC DUTY
EDIT START 25 FRAME ON
COUNT DOWN
PULSE GEN
TRACKING MMV
PRE SET MMV
DUTY MMV
R36
R38
PRESET
TRACKING
TP6 CAPSTAN SAMPLING
C31
C32
IC 301
SOL ON (from MECHA-CON)
SOL. OFF (from MECHA-CON)
MMV
PRE DRIVE
12V
BRAKE SOLENOID
SOL SW
CN7
IC 6
END/SOL. POS/P.SAVE (to MECHA-CON)
CN5
LOGIC
AMP
LED DRIVER
POWER SAVE SW
STOP
TP13 END SENSOR
END SENSOR
LED
DRUM FF (to Y/C)
UNLOADING
LOADING
IC 302
LOADING MOTOR
REEL MOTOR POWER (from SW REG)
REEL REV
REEL FWD
Q306
TP301 REEL MOTOR
REEL MOTOR
CAP REV
R55
R56
R57
IC4
D4
D5
R58
R32
R54
C41
C40
IC5
TP7 DRUM PHASE ERROR
R72
R69
C206
D201
R206
DRUM F/V ADJ
Q2 SEARCH : ON
SEARCH
R50
SEARCH SPEED
CTL PULSE TP2
IC 2
CTL PB AMP
CTL HEAD
CN4
IC 202
NOISE CANCEL (to AUDIO)
Vcc/2
COMP
SAMPLE & HOLD
SAW TOOTH GENER
LOGIC CONTROL
COIL PRE DRIVER
DRUM MDA
HG DRIVE
TRAPEZOID GENER
HG
HG1
HG2
DRUM MOTOR
COIL
9V
REG. 5V
Q202
CN3
CN1
SW REG
1 0
R94
TP14 CAP. BRAKE
D13
SOL. ON
SOL. OFF
Q4 H:ON
C42
C43
D21
R63
R65
D9
D8
R64
R90
D6
D7
R59
R60
R61
R62
CAP. PHASE ERROR TP12
R70
R71
CAPSTAN MOTOR
FG COIL
IC 1
C2
AMP
TRAPEZOID
SCHMITT
5V
R2
CAP SAMPLE POS.
TP1 CAP. FG
1/3
POWER ON RY1
R123
F1
UN REG. 12V
R124
Q11
RY1
LOADING MOTOR CAMERA 12V
Q5
POWER ON (CAMERA)
L:ON
Q8
D23
R122
Q9
Q10
R126
R125
R127
F2
SW. REG.
F3
DRUM, CAP, REEL MOTOR MECHA-CON
POWER ON (LOCAL or REMOTE)
Q6
R116
R117
Q7
POWER OFF
CAP FG OUT (to MECHA-CON)
0 1 SERVO

Fig. 3-35 Servo block diagram

3.2 SERVO CIRCUIT

Special Features of the HR-C3's Servo Circuit

1) New type of DD drum motor.
2) DD motor employed as capstan motor.
3) Compact design using chip components and flat ICs.
4) Energy-saving design.

3.2.1 Block diagram description

Refer to the block diagram.
The relation of reference and comparison signals in the servo circuit are shown in the chart below.

1. Drum Servo System

- For Recording

The reference signal for the drum servo circuit in recording is the vertical sync signal of the video input. The comparison signal is supplied by the drum pulse. Sync is separated from the video input signal at the Y/C board and fed to CN1 pin 13 on the servo board. The vertical input sync signal is applied to pin (23) of IC3, and transformed to 25 Hz by a 1/2 count-down. Then the signal is supplied to the Rec Phase MMV (monostable multivibrator) via the REC switch. The Rec Phase MMV adjusts the recording phase (switching point), and sends the reference signal to the phase comparator. The comparison signal consists of a 25-Hz trapezoidal waveform signal, produced by the drum pulse applied to IC3, pin 3 and routed through the Switch Phase MMV of CH-1 and CH-2 from the drum FF. The phase comparator produces an error voltage by comparing the reference and the comparison signal. This error voltage appears at pin 14 of IC3, and is contained within the range of appr. 2 V–3 V DC by a DC limiter circuit. The phase error voltage is then fed to IC5, pin 12 and mixed with the speed error voltage. It is supplied to the switching regulator. In the switching regulator circuit, this motor control voltage is amplified by approx. 2.6 times and then supplied to the drum MDA circuit to power the drum motor.

- For Playback

The 25-Hz signal generated by the X'tal oscillator serves as reference signal for the drum servo circuit in playback. Otherwise, circuit operation is the same as for recording. The V-pulse generator circuit operates during Search Rewind, Search FF, Pause (in playback), and Reverse modes. The V-pulse generator circuit is controlled by IC3, pin 31: when pin 31 is high, the V-pulse is generated.

	DRUM			CAPSTAN		
	PHASE		SPEED	PHASE		SPEED
	REFERENCE	COMPARISON		REFERENCE	COMPARISON	
REC	V. SYNC	DRUM PULSE	DRUM F/V (270 Hz)	X'TAL	CAPSTAN FG 25 Hz	CAPSTAN FG 252.5 Hz
PLAYBACK	X'TAL	"	"	X'TAL	CTL PULSE	"
SEARCH FF	X'TAL	"	"	X'TAL	1/3 CTL PULSE 25 Hz	CAPSTAN FG 757 Hz
SEARCH REW	–	–	"	–	"	"
EDIT	X'TAL (V. sync Reset) ⟶ V. SYNC	DRUM PULSE	"	X'TAL (V. sync Reset) ⟶ X'TAL	CTL PULSE (FG Reset) ⟶ CAP. FG	CAPSTAN FG 252.5Hz

Table 3-1

		Speed Servo		Phase Servo		MIX	MDA	Motor
		IC202 Pin 9	IC202 Pin 7	IC5 Pin 3	TP7	IC5 Pin 14		
Phase Error	Delayed	–	–	Increase	Increase	Increase	Increase	Increase
	Normal	2.5 V	2.6 V	2.5 V	2.5 V	1.3 V	3.5 V	25 Hz
	Advanced	–	–	Decrease	Decrease	Increase	Decrease	Decrease
Speed Error	Slow	Increase	Increase	–	–	Increase	Increase	Increase
	Normal	2.5 V	2.6 V	2.5 V	2.5 V	1.3 V	3.5 V	25 Hz
	Fast	Decrease	Decrease	–	–	Decrease	Decrease	Decrease

Table 3-2

- Speed Control

  As opposed to previous models, the HR-C3 employs a new type of drum DD motor without FG system. F/V conversion is performed using the drum MDA switching pulses from the Hall element.

2. Capstan Servo system

- For Recording

  X1 generates a 32.768-kHz signal, which is divided by the factor 1559 to arrive at a 21-Hz signal which serves as capstan reference signal for recording. The comparison signal is arrived at by frequency division from the capstan FG signal. The 252.5-Hz capstan FG signal is amplified by IC1 and fed to IC3, pin 25. Inside IC3, the FG signal is subjected to count-down and sent as a 21-Hz sampling pulse to the phase comparator. There, it is compared with the trapezoidal waveform signal from the X'tal, and the error voltage appears at IC3, pin 33. This error voltage passes through the non-linear circuit made up of D8 and D9, and is contained within the range of 1.9 V – 3.1 V by a DC limiter circuit. After passing the VF circuit of IC5, pins 5, 6 and 7, the voltage is mixed with the speed error voltage and sent to the switching regulator circuit. There, the input error voltage is amplified by approx. the factor 2.6 and the voltage is applied to the MDA inside the capstan motor as control voltage.

- For Playback

  The capstan comparison signal for playback is derived from the CTL pulses stored on the tape during recording. Therefore, during playback the phase comparator compares the CTL pulse and the trapezoidal waveform signal from the X'tal. Also, during playback the tracking MMV performs phase adjustment of the CTL pulse for interchangeability.

3. Power Line Configuration

The HR-C3 possesses basically 7 power supply lines. For servicing, it is useful to keep the line configuration in mind. Please refer to the power supply line chart.

The 12 V DC power supplied from the battery or the AC adapter is fed to the power-on/off relay via F1. Regarding operation of the power-on/off circuit, refer to the mechacon circuit description.

Having passed the relay, the 12 V DC power supply is divided into 3 routes.

1) Direct line : loading motor, brake solenoid, camera 12 V
2) via F2 : 5 V line, 9 V line
3) via F3 : motor power supply

Therefore, if a fuse has blown, the cause can be traced separately for the 3 power supply lines.

1) 12 V line (direct) : loading motor, solenoid, camera 12 V
2) 5 V line : servo circuits, video circuit (color IC7 power supply), mechacon circuits
3) 9 V line : drum MDA circuit, loading motor reference power supply, video circuits, end sensor LED drive circuit, audio circuit, solenoid circuit, mechacon circuit
4) Reel motor power : reel motor power supply
5) Capstan motor power : capstan motor power supply
6) Drum motor power : drum motor power supply
7) 12 V line (via F3) : mechacon circuit (low battery voltage sensing circuit)

The above described lines make up the power supply circuit.

		Speed Servo		Phase Servo	Mix	Motor	
		TP-1	IC1 Pin 15	TP12	IC5 Pin 8	MDA IN	Motor
Phase Error	Delayed	–	–	Decrease	Increase	Increase	Increase
	Normal	252.5 Hz	2.3 V	2.5 V	1.2 V	1.3 V	Constant
	Advanced	–	–	Increase	Decrease	Decrease	Decrease
Speed Error	Slow	Decrease	Increase	–	Increase	Increase	Increase
	Normal	252.5 Hz	2.3 V	2.5 V	1.2 V	1.3 V	Constant
	Fast	Increase	Decrease	–	Decrease	Decrease	Decrease

Table 3-3

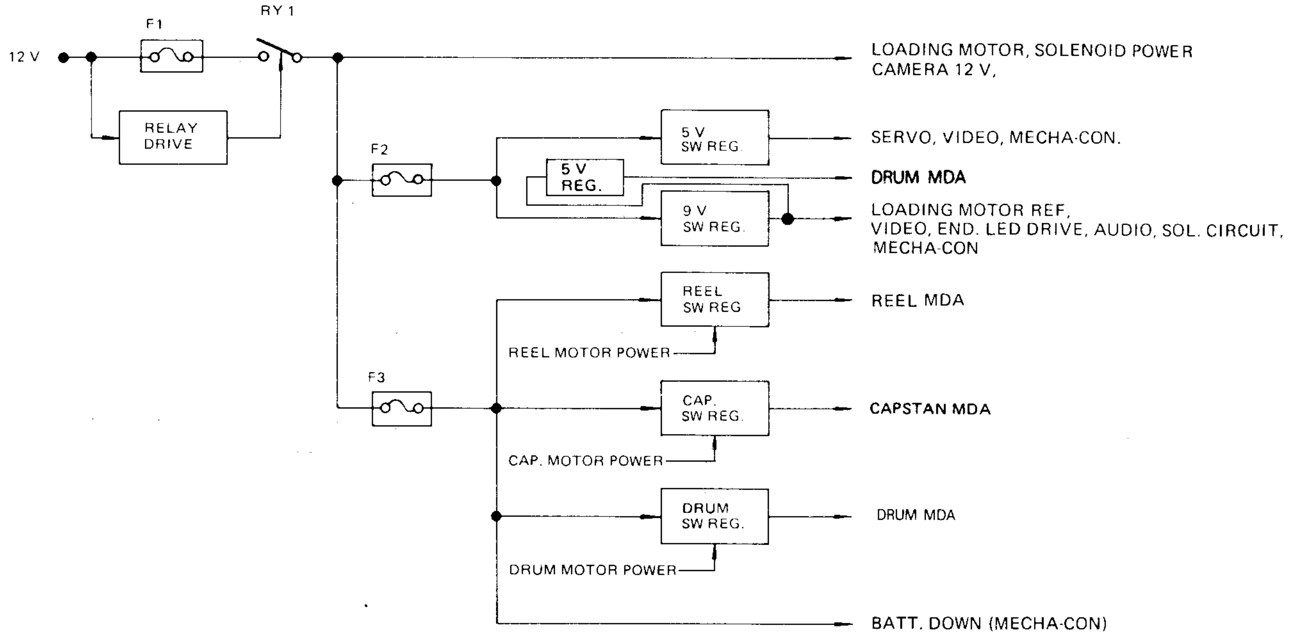

RY 1
F1
12 V
RELAY DRIVE
LOADING MOTOR, SOLENOID POWER
CAMERA 12 V,
F2
5 V SW REG
5 V REG.
9 V SW REG
SERVO, VIDEO, MECHA-CON.
DRUM MDA
LOADING MOTOR REF,
VIDEO, END. LED DRIVE, AUDIO, SOL. CIRCUIT, MECHA-CON
REEL SW REG
REEL MDA
REEL MOTOR POWER
F3
CAP. SW REG.
CAPSTAN MDA
CAP. MOTOR POWER
DRUM SW REG.
DRUM MDA
DRUM MOTOR POWER
BATT. DOWN (MECHA-CON)

Fig. 3-36 Power supply system

3.2.2 Switching regulator circuit

1. Outline

The HR-C3 employs a switching regulator circuit for the power supply in order to achieve low power consumption.

Recently, switching regulator circuits are widely used as power supplies in microcomputer applications, etc. In the following explanation, at first a comparison to ordinary regulator circuits is given.

In a conventional regulator circuit with 12 V input and a 9 V regulated output, a voltage drop of 3 V is sustained at the transistor in the regulator circuit. In the case of a 100 mA current, the resulting power consumption is 3 V x 100 mA = 300 mW.

In a switching regulator circuit as employed in the HR-C3, however, the transistor in the regulator circuit completely switches ON and OFF, controlled by a switching pulse of several tens of kHz generated by an oscillator. Therefore, the power consumption at the transistor during the OFF interval is zero (completely switched off) and in the ON interval (completely switched on), the voltage drop at the transistor is only approx. 0.1 V. (Refer to the chart.)

As a result, the power consumption for a current of 100 mA during the ON interval of the transistor is 100 mA x 0.1 V = 10 mW. In comparison to a conventional regulator circuit, the switching regulator circuit's power consumption of 10 mA means a reduction to approx. 1/30.

Refer to the basic block diagram.

The input of 12 V is supplied to the low-pass filter by TR1 as a continuous pulse. The low-pass filter smoothes the continuous pulse to an output of 9 V. This 9 V output is adjusted by the 9 V ADJ. VR and supplied to the DC comparator 1. The comparator 1 compares it with the fixed voltage from the regulator and feeds it out to comparator 2. Comparator 2 compares the DC voltage output from comparator 1 with a triangular waveform signal generated by an oscillator and produces a pulse to be fed to the E. switch. Because the pulse width is altered by alterations in the 9 V DC, ON/OFF of TR1 is controlled to achieve stable output at all times.

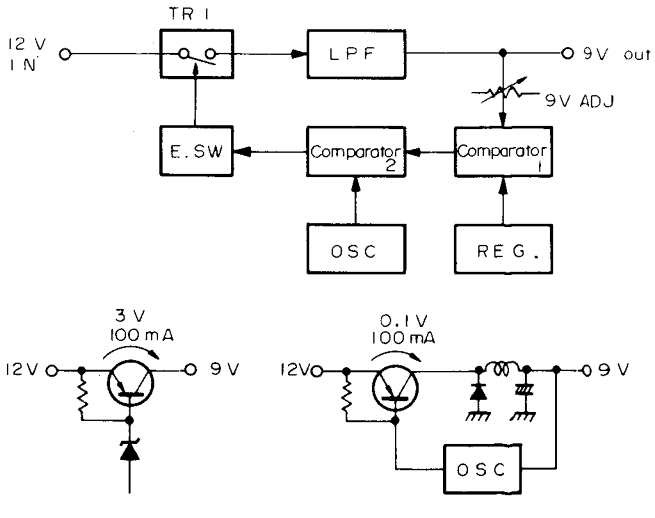

TR 1
12 V IN
LPF
9V out
9V ADJ
E.SW
Comparator 2
Comparator 1
OSC
REG.
3 V
100 mA
12V
9 V
0.1 V
100 mA
12V
9 V
OSC

Fig. 3-37 Switching regulator principle

2. Description of Circuit operation

The Figure 3-38 shows the 9 V line configuration of the switching regulator circuit.

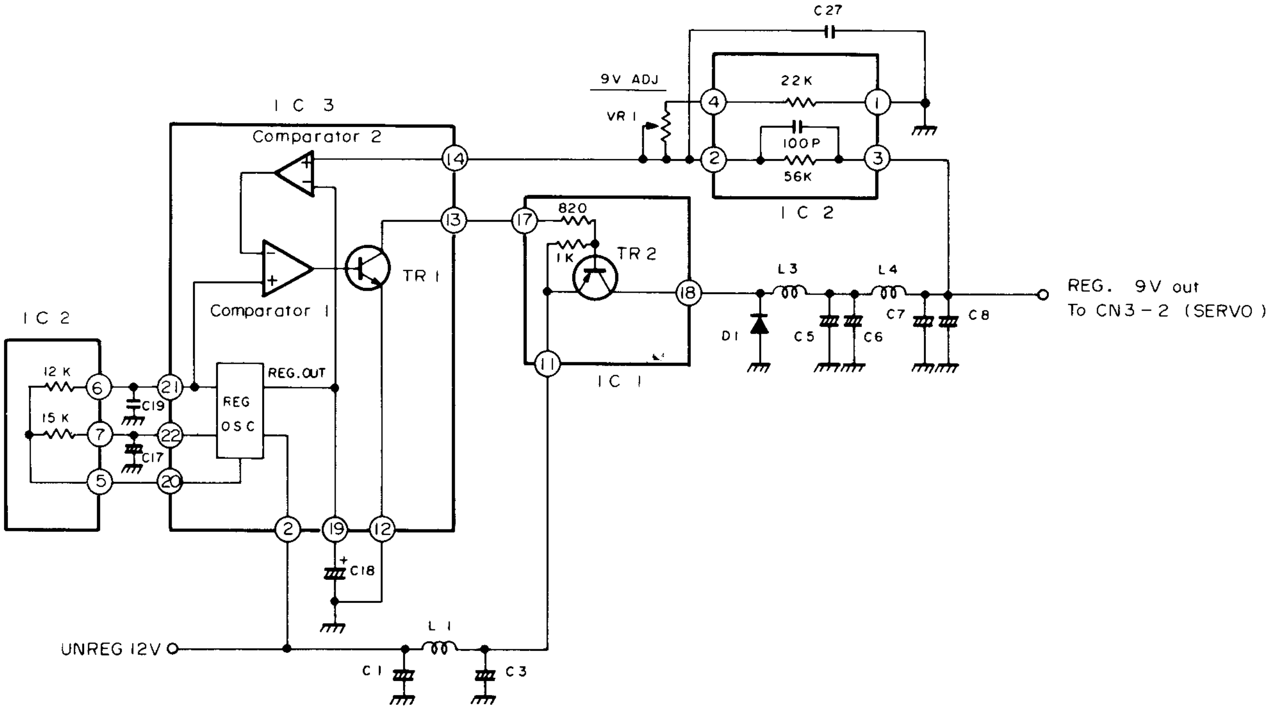
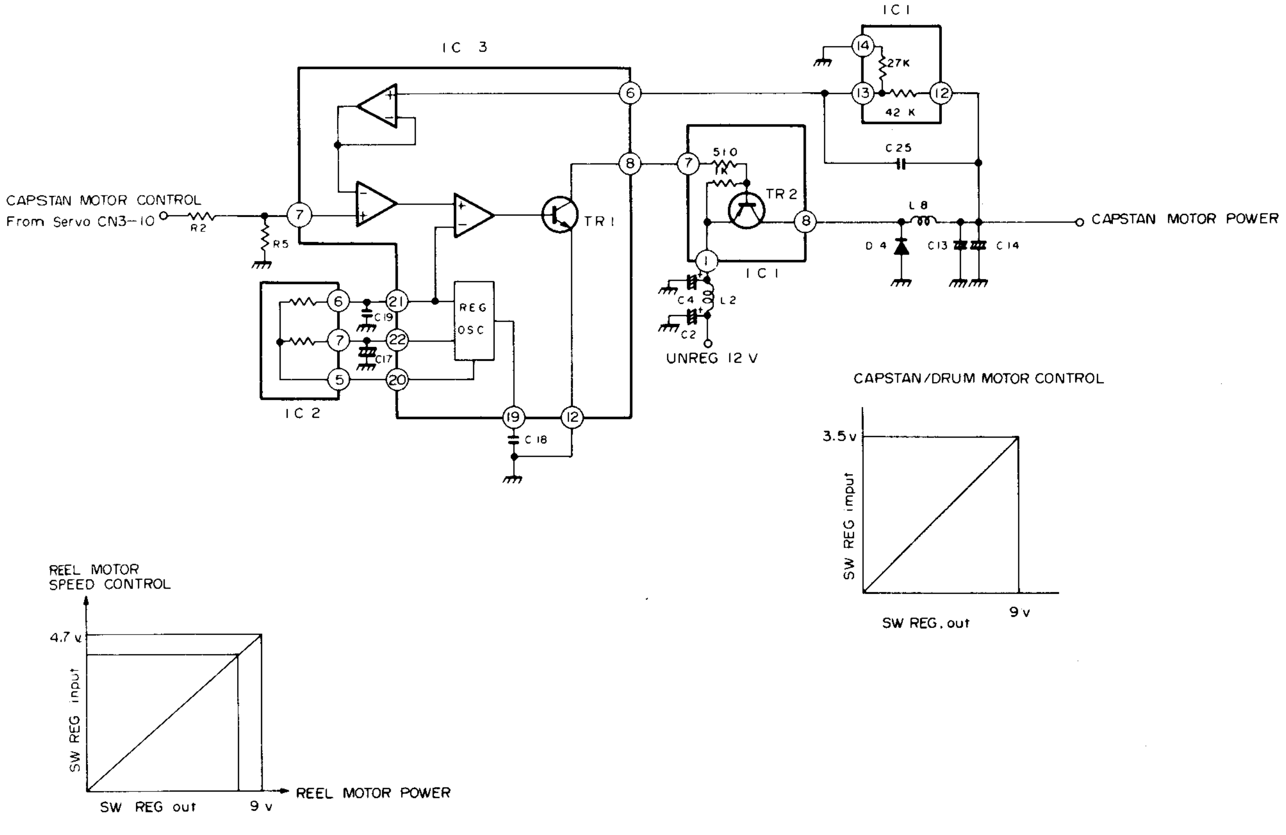

C27
9V ADJ
VR 1
22K
100P
56K
IC 2
IC 3
Comparator 2
Comparator 1
TR 1
820
1K
TR 2
IC 1
L3
L4
D1
C5
C6
C7
C8
REG. 9V out
To CN3 - 2 (SERVO)
IC 2
12 K
15 K
C19
C17
REG.OUT
REG OSC
C18
L 1
C 1
C 3
UNREG 12V

Fig. 3-38 9 V power supply system


IC 3
IC 1
27K
42 K
C25
510
1K
TR 2
TR 1
L8
CAPSTAN MOTOR POWER
D 4
C13
C14
CAPSTAN MOTOR CONTROL
From Servo CN3-10
R2
R5
C4
L2
C2
UNREG 12 V
REG OSC
C19
C17
C18
IC 2
CAPSTAN/DRUM MOTOR CONTROL
3.5v
SW REG input
SW REG. out
9v
REEL MOTOR
SPEED CONTROL
4.7v
SW REG input
SW REG out
9v
REEL MOTOR POWER

REEL MOTOR CONTROL

Fig. 3-39 Cap. motor power supply system

The oscillator in IC3 is made up of a CR combination by R (inside IC2) connected to pin 21 and C19. This circuit oscillates with a frequency of approx. 39 kHz. The generated signal with triangular waveform is applied to the (+) input side of DC comparator 1 inside IC3.
This triangular signal causes an output pulse to be fed to the base of TR1 from the voltage charged at the (–) side. TR1 switches ON while the positive pulse is applied to its base and sends a reactive pulse to TR2 inside IC1.

Because an unregulated 12 V voltage lies at the emitter of TR2, the 12 V voltage appears at its collector while TR2 is ON. This output pulse of 12 V (approx. 40 kHz) is smoothed to 9 V by the low-pass filter made up of L3, L4, C5, C6, C7, C8. This 9 V output voltage is fed back to IC2 pin 3, adjusted by VR1 9 V ADJ. and applied to IC3 pin 14. At the comparator 2 inside IC3, the feedback voltage potential is amplified and again fed back to the (–) input side of the comparator. Depending on the potential variations of this (–) input, the threshold potential of the comparator varies, determining the output pulse width. Thereby 9 V line variations caused by varying load conditions are compensated for.

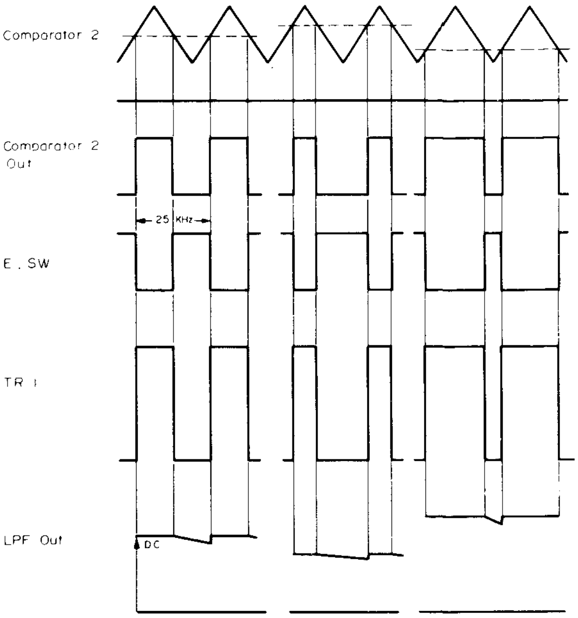


Fig. 3-40 Switching regulator timing

3.2.3 Servo related circuits

1. Brake Solenoid circuit

The solenoid driver circuit employs a transistor configuration because during solenoid operation a maximum electrical current of approx. 2 A must be sustained.
The pre-driver circuit IC301 is driven by the solenoid-on/solenoid-off pulses supplied from the mechacon circuit. Circuit operation is basically the same as with other switch circuits. As with the loading motor drive circuit, the power supply for the solenoid drive is 12 V and the 9 V power supply is used as reference voltage to control the current flowing through the solenoid.

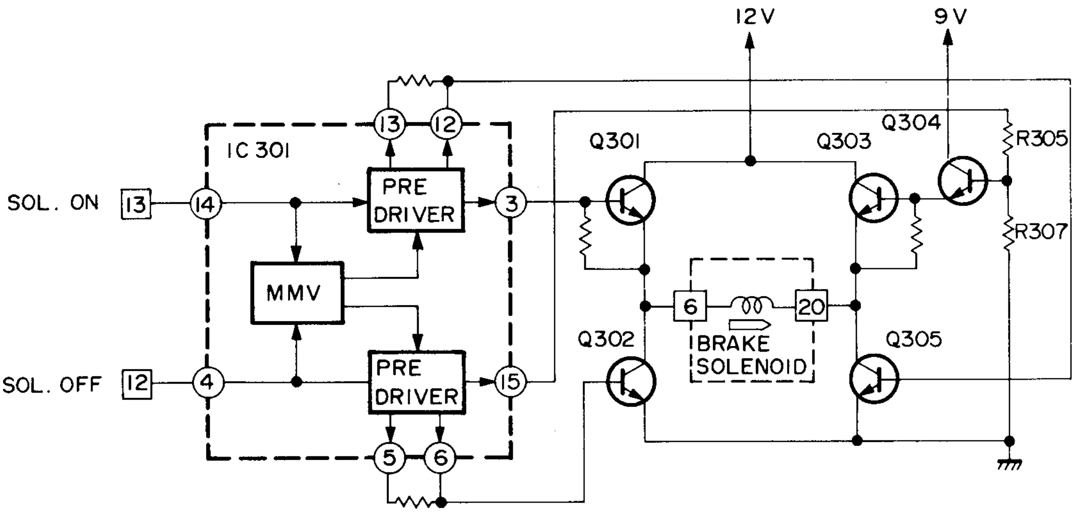


Fig. 3-41 Solenoid drive circuit

2. Solenoid on
   The solenoid-on pulse of 100 msec is supplied from the mechacon circuit to IC301 pin 14. This sets pins 3, 12 and 13 high, then Q301 and Q305 switch on. The solenoid is energized by 7 – 8 V DC.
3. Solenoid off
   The solenoid-off pulse is applied to IC301 pin 4. For release of the solenoid, it is only necessary to create a magnetical field to overcome the holding magnet power, and it suffices to drive the solenoid with approx. 3.5–4.5 V. The output of IC301 pin 15 is divided by R305 and R307, and a voltage of approx. 4 V is applied to the solenoid coil via Q304 and Q303.
   At the same time, Q302 becomes ON, and the solenoid switches off.
4. Loading Motor Drive current
   The loading motor is powered from the 12 V power supply. The servo circuit IC302 forms a switch circuit for the loading motor. The 12 V power supply is connected to pins 2 and 8 of IC302. The loading or unloading conditions are applied to pins 4 and 6 of IC302 from the mechacon circuit. These control the forward or reverse rotation of the loading motor. To pins 1 and 9 of IC302 the reference voltage is applied for fixed rotation (8 V) of the loading motor. If used directly, variations in the 12 V power supply would cause irregular motor rotation. To prevent this, the 9 V reference voltage is used to achieve stable rotation.

   The IC302 reduces the power supply to 8 V for stable rotation of the loading motor. Therefore, IC302 has a maximum power consumption of 4 V x 400 mA = 1.6 W during loading motor operation. However, this does not consist a problem, because the motor operation time during loading or unloading is only approx. 4 seconds. The reel motor circuit employs the same configuration, but as the reel motor is rotating constantly, an IC with low power consumption is used.

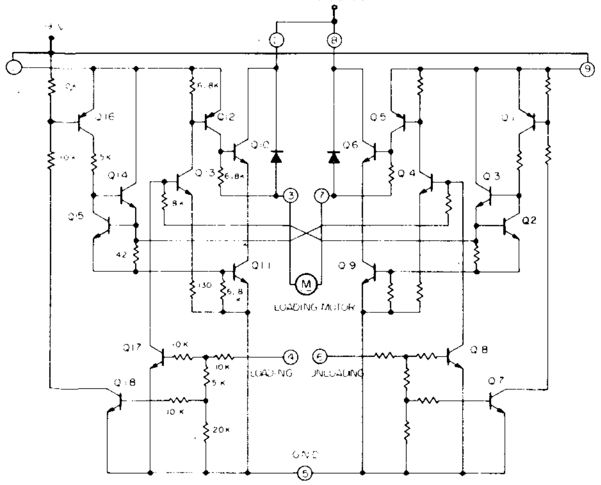


Fig. 3-42 IC301

5. Reel Motor Drive circuit
   The principle of this circuit is the same as for the loading motor circuit, but in comparison to IC302, IC303 is designed for low power consumption. This design is necessary because the operating time of the reel motor is much longer than that of the loading motor.

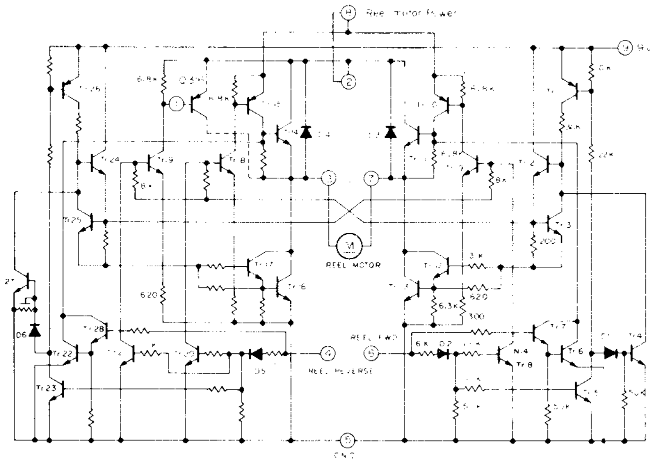


Fig. 3-43 IC302

6. End Sensor circuit
   The HR-C3 does not possess a cassette lamp due to space considerations. Therefore, end-of-tape sensing in the Fast-Forward and Rewind modes is performed by detecting the stop of reel rotation and setting the unit to the Stop mode. As the tape is pulled by the pinch-roller during Play and Recording, end-of-tape sensing in this case is performed by an end sensor. This end sensor operates only in the Play, Record and Search FF modes. The end sensor circuit and operation timing is shown in the chart.

   In ordinary optical sensing circuits, a LED is constantly driven and a photo sensor detects the light from the LED. This requires a current of approx. 200 mA for the LED. In the case of the HR-C3, driving the LED constantly would mean a power consumption of 5 V x 200 mA = 1 W. To avoid this power loss, the HR-C3 employs a pulse drive system for the end sensor drive circuit.

   As a reference signal to drive the end sensor LED, the drum FF signal is used. Because the drum FF signal is 25 Hz, it would cause the LED to light for 20 msec if used directly, which would not yield sufficient power conservation. Therefore, the MMV of IC6 is employed to change the LED drive pulse to shorter 500 μsec intervals. The output drives Q3 to control the LED.

   At tape end, when LED light reaches the end sensor, high potential appears at IC6 pins 10 and 11. Pin 11 is the time constant and a voltage difference becomes produced between pins 10 and 11, yielding an approximately 500 μsec pulse, which is sent to the logic circuit. The logic circuit increases the time in order to allow application to the mechacon CPU. Solenoid and power save switches are also connected to the logic circuit. These data are applied to the mechacon circuit according to mode.

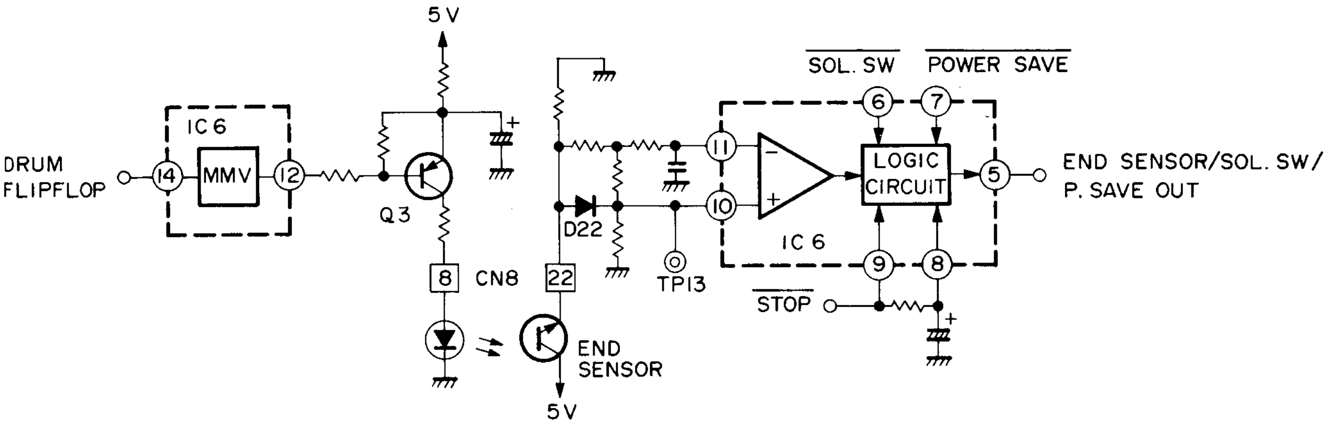

5V
DRUM FLIPFLOP
IC6
14
MMV
12
Q3
8
CN8
22
D22
TP13
END SENSOR
5V
11
10
IC 6
SOL. SW
POWER SAVE
6
7
LOGIC CIRCUIT
5
END SENSOR/SOL. SW/ P. SAVE OUT
9
8
STOP

Fig. 3-44 End sensor drive circuit

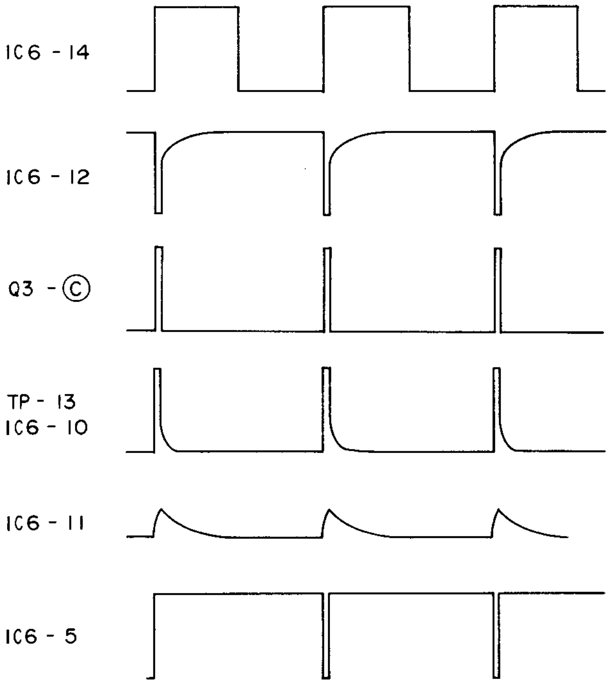

IC6 - 14
IC6 - 12
Q3 - Ⓒ
TP - 13
IC6 - 10
IC6 - 11
IC6 - 5

Fig. 3-45 End sensor drive timing

7. Drum F-V Converter Circuit

F-V (frequency to voltage) converter and drum motor predrive circuits are contained in IC202. In order to reduce power consumption, the Hall element drive voltage is normally low potential, which becomes high only in the period just prior to zero cross point detection.

As indicated in Fig. 3-46, the respective Hall element outputs are applied between IC202 pins 22 and 23 (HG-1) and pins 20 and 21 (HG 2). The zero cross point of the HG 1 and HG 2 waveforms is detected by the internal comparator of the IC. The logic circuit then yields the waveforms shown in Fig. 3-46 at pins 15 and 18, which are employed for switching the drum motor coil current. Hall elements HG 1 and HG 2 are separated by a distance corresponding to a 90° electrical angle. As the motor turns the S and N magnetic poles of the rotor pass above the Hall elements. The time required for the magnetic polarity change between S and N is detected.

In the HG 1 and HG 2 waveforms of Fig. 3-46, the (+) side indicates N pole passage and the (–) side S pole passage. A waveform synchronized to the zero cross point of the HG 1 and HG2 appears at pin 14. A pulse is produced with approximately 1/2 the interval of this falling component, which is employed as the reset pulse for the sawtooth generator circuit.

At the rising point of HG 2, this is employed as the sampling pulse for holding the pin 11 sawtooth voltage. The held voltage is obtained at pin 10, then amplified and sent from IC202 pin 7 to IC5 pin 13 for mixing with the drum phase error voltage.

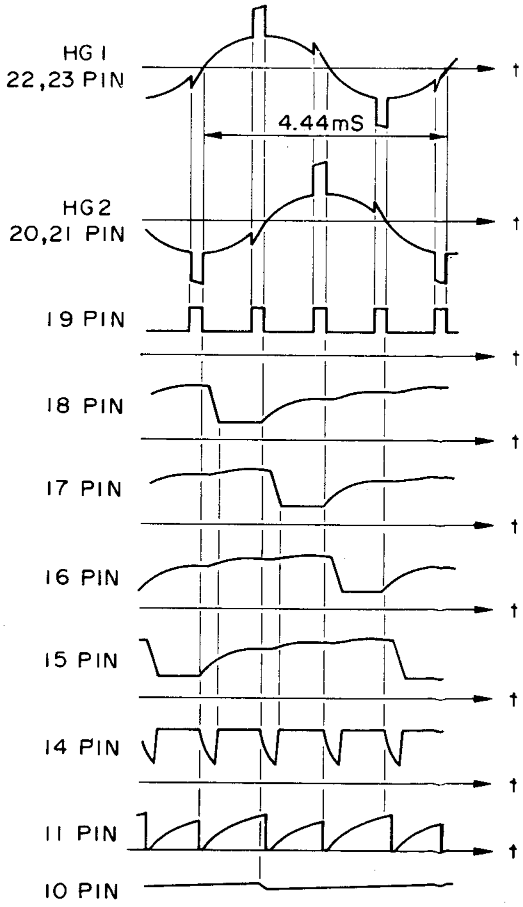

HG I
22,23 PIN
4.44mS
HG2
20,21 PIN
19 PIN
18 PIN
17 PIN
16 PIN
15 PIN
14 PIN
11 PIN
10 PIN
t

Fig. 3-46 Drum F-V timing

8. Capstan Error DC Limiter circuit

The capstan phase error voltage is routed through the nonlinear circuit made up of D8 and D9 and supplied to the DC limiter circuit made up of IC4, D6 and D7. To the (+) input side of the DC limiter circuit, a fixed resistor-divided voltage is applied. To IC4 pin 3 approx. 3.1 V DC and to IC4 pin 5 approx. 1.9 V DC are aplied. Therefore, if the capstan error voltage is between 1.9 V–3.1 V DC, the DC limiter circuit is inactive and the error voltage is directly fed to the motor. When the capstan error voltage exceeds 3.1 V DC, the output of IC4, pin 1 reverts to low potential, causing D6 to become ON and contain the error voltage at 3.1 V. When the error voltage falls below 1.9 V DC, IC4 pin 7 becomes High, causing a current to flow through D7 and containing the capstan error voltage at 1.9 V. In this way, the capstan error voltage is controlled to remain in the range of 3.1 V DC–1.9 V DC, with a center potential of approx. 2.5 V DC.

9. Drum DC Limiter circuit

During normal playback mode, DC limiter circuit operation is the same as for the capstan error DC limiter circuit.

In search FF, high potential appears at IC7 pin 12 and low at IC10 pin 10. The DC limiter voltage at IC4 pin 12 changes to approximately 2.6 V DC. At this time, D28 switches on to add high potential to the drum phase error voltage. The DC limiter circuit then functions to maintain the drum phase error voltage at approximately 2.6 V.

Similarly, during search REW, the drum phase error voltage is fixed at approximately 2.2 V.

10. Mode Change Ligic circuit

Due to space considerations of the mechacon circuit, the logic circuitry for mode change is included in the servo circuit. Explanation of logic for audio and video circuits and for servo circuits is given separately.

- Audio, Video control

  As shown in the chart, 4 kinds of signals (Video Rec Mute, Audio Rec, Audio Dub, Video EE) for control of

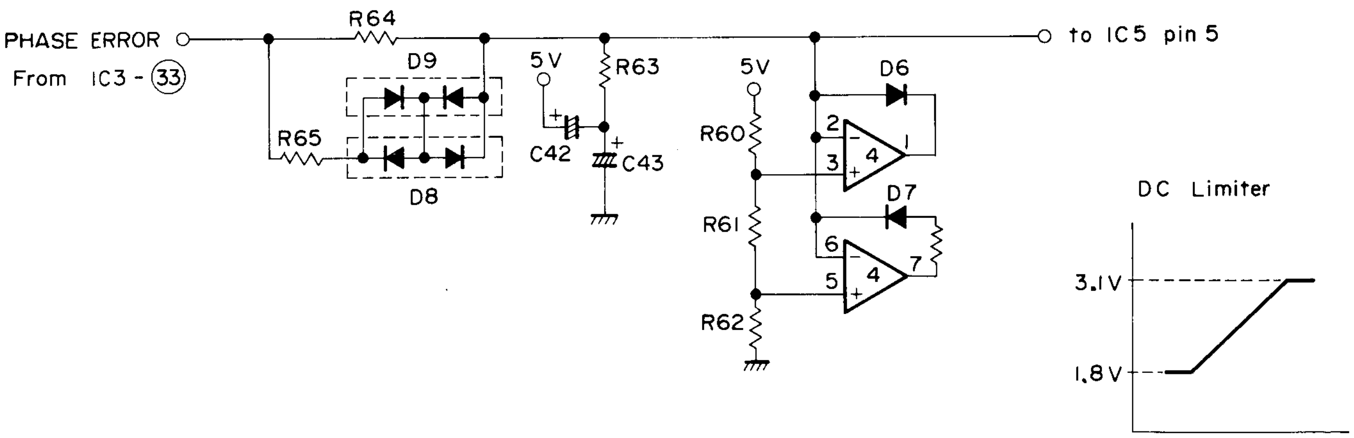

PHASE ERROR
From IC3-㉝
R64
D9
R65
D8
5V
R63
C42
C43
5V
R60
R61
R62
D6
D7
2
3
4
1
6
5
7
to IC5 pin 5
DC Limiter
3.1V
1.8V

Fig. 3-47 Capstan DC limiter circuit

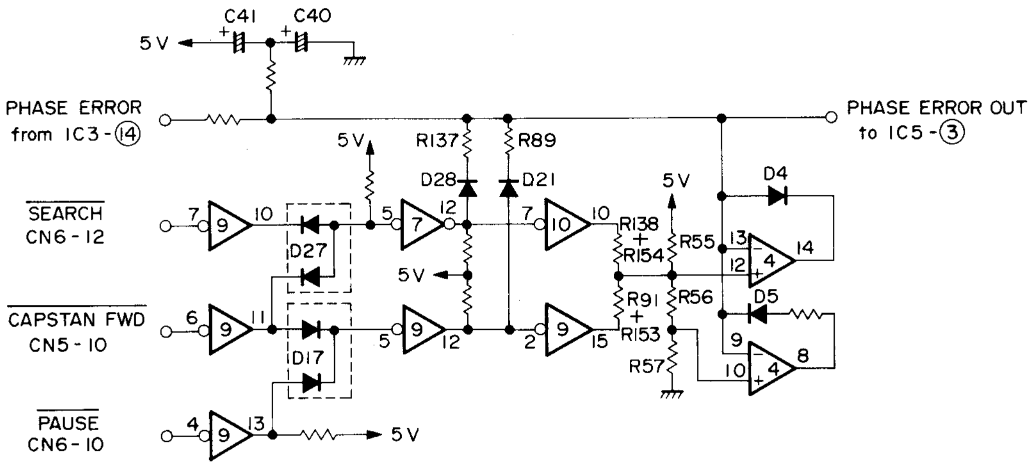

C41
C40
5V
PHASE ERROR
from IC3-⑭
SEARCH
CN6-12
CAPSTAN FWD
CN5-10
PAUSE
CN6-10
D27
D17
5V
R137
R89
D28
D21
5V
R138
R154
R55
R91
R153
R56
R57
D4
D5
PHASE ERROR OUT
to IC5-③

Fig. 3-48 Drum DC limiter circuit

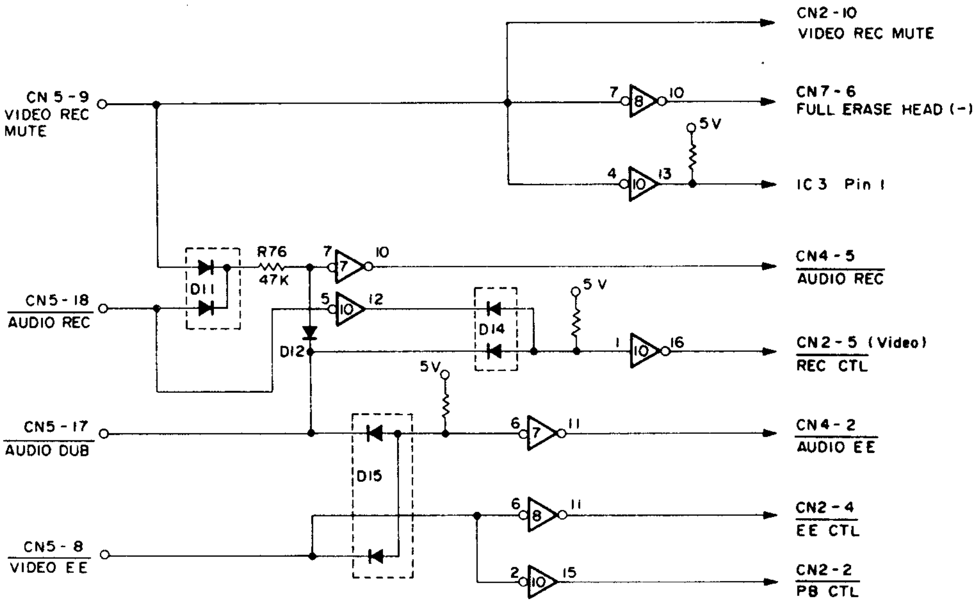

CN5-9
VIDEO REC MUTE
CN5-18
AUDIO REC
CN5-17
AUDIO DUB
CN5-8
VIDEO EE
D11
R76
47K
D12
D14
D15
5V
CN2-10
VIDEO REC MUTE
CN7-6
FULL ERASE HEAD (-)
IC3 Pin 1
CN4-5
AUDIO REC
CN2-5 (Video)
REC CTL
CN4-2
AUDIO EE
CN2-4
EE CTL
CN2-2
PB CTL

Fig. 3-49 A/V system control

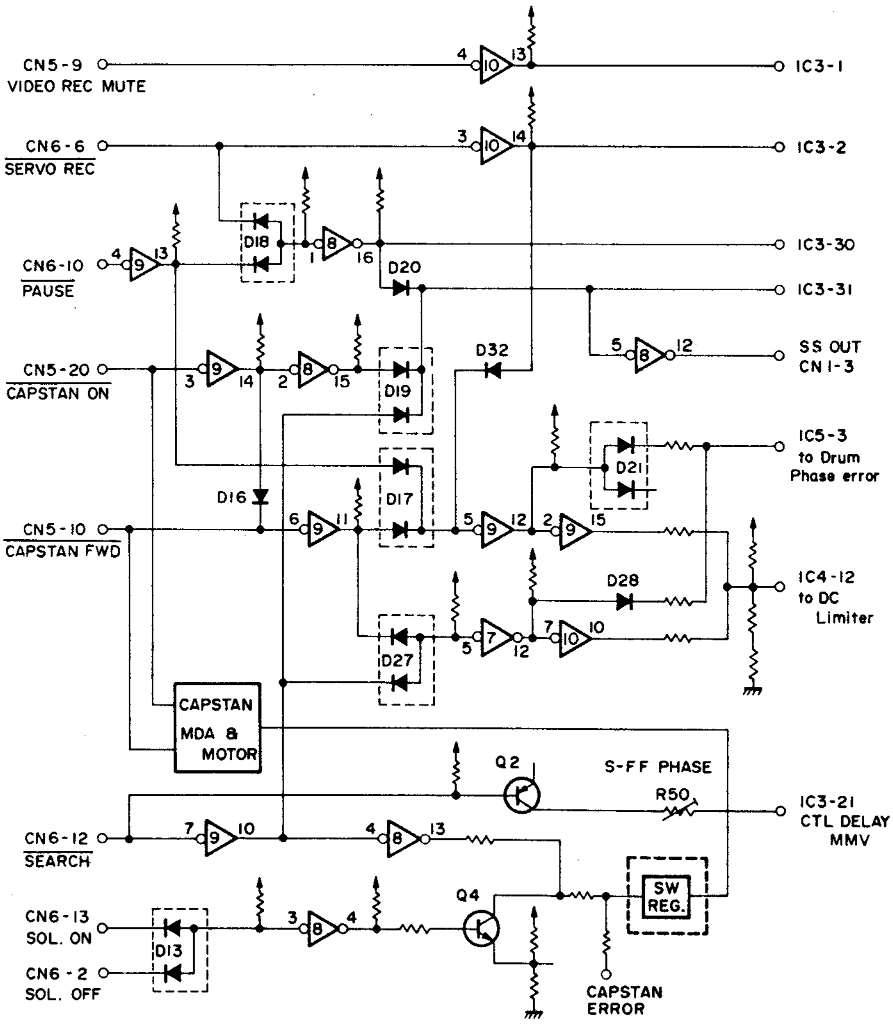

CN5-9
VIDEO REC MUTE
CN6-6
SERVO REC
CN6-10
PAUSE
CN5-20
CAPSTAN ON
CN5-10
CAPSTAN FWD
CN6-12
SEARCH
CN6-13
SOL. ON
CN6-2
SOL. OFF
D18
D20
D32
D19
D17
D16
D21
D28
D27
D13
IC3-1
IC3-2
IC3-30
IC3-31
SS OUT
CN1-3
IC5-3
to Drum
Phase error
IC4-12
to DC
Limiter
CAPSTAN
MDA &
MOTOR
Q2
Q4
S-FF PHASE
R50
IC3-21
CTL DELAY
MMV
SW
REG.
CAPSTAN
ERROR

Fig. 3-50

the audio and video circuits are supplied from the mechacon circuit. These data are expanded to serve as control data for each circuit.

- Servo control
  1) IC3 pin 1, 2 control
  Pins 1 and 2 of IC3 serve as control line for mode change. With this input, mode change for Recording, Playback and Editing is performed.
  2) IC3 pin 30, 31 control
  This input controls the V pulse generator circuit inside IC3. Pins 30 and 31 of IC3 do not have any other function.
  3) Operation of Q2
  During Search, these transistors become ON, for speed control during search and phase control during Search FF.
  4) Operation of Q4
  Q4 becomes ON for the approx. 100 msec interval of the solenoid drive pulse. The capstan motor rotation is reversed by potential determined by TP14, resulting in a breaking effect on the motor.
  5) Compensation of Relative Speed during Search
  The relative speed changes by approx. 0.5% when the tape speed is doubled. Therefore, the relative speed during Search FF changes by (3 – 1) x 0.5 = 2 x 0.5 = 1.0%. Relative speed is reduced by 1.0%. During Search Rewind the relative speed change becomes (3 + 1) x 0.5 = 2.0%.

3.3 VIDEO SYSTEM

3.3.1 Luminance signal Recording system

1. Signal Flow (Fig. 3-55)
The video signal from the camera connector is fed to the Y/C circuit via the mechacon, servo and MDA boards. When the input video signal is in the E-E mode, it is terminated with 75 ohms by the electronic switch Q2 and branched into two lines. One leads to pin 16 of IC7 for input to the color recording circuit. The other is sent to an AGC circuit via pin 21 of IC6. At the AGC circuit, the sync level is controlled at a fixed value and the video signal is again separated into two lines. One leads through the E-E amp, electronic switch and pin 31 and is sent to the video output circuit as E-E signal. (For explanation of the video output circuit, see the section on playback signal flow.) The other line signal leads through an electronic switch and pin 17 to IC5, pin 2. After passing the emitter-follower inside IC5, the signal is fed from of pin 1 of IC5 to the low-pass filter (LPF) 1. The color signal components are removed, and the luminance signal components only are obtained. LPF 1 and EQ2 serve to improve the pulse characteristics of the luminance signal. The luminance signal is amplified inside IC6 and branched into 3 lines after passing an electronic switch.
On line leads to the sync separation circuit. The second line passes a clamp circuit and is supplied to the AGC detector circuit. The main signal is sent to IC2 from pin 7 after passing 4.43 MHz trap L29 and C86. This luminance signal enters IC2 at pin 13. Its sync tip is clamped by the clamp circuit and then the signal enters a nonlinear emphasis circuit. This circuit automatically varies the amount of pre-emphasis applied, according to the level of the input video signal.
At low signal levels, where noise is most apparent, the amount of pre-emphasis is increased. In conjunction with the following main emphasis circuit, this serves to improve S/N ratio in the mid and high frequency regions of the signal. The main emphasis circuit applies a constant amount of pre-emphasis with every signal level, but an apparent compression of spike components is achieved by demodulating the spike components in the white/dark clipping circuit output and adding these to the signal. Thereby the spike components can be demodulated in playback, and pulse characteristics are improved.
In the white/dark clipping circuit, sudden spike components of the luminance signal beyond a certain level (i.e. overshoot and undershoot components) are clipped.

Then the luminace signal is converted in the FM modulator circuit into an FM signal with sync tip of 3.8 MHz and white peak of 4.8 MHz. The FM modulated luminance signal is routed through a high-pass filter attenuating those frequencies in the FM signal's lower sideband which are in the same region as the down-converted color signal. After passing through an emitter-follower, the signal is adjusted by R13 to the optimum recording voltage. Then it is mixed with the down-converted color signal and fed to the recording amplifier 1.

The input of the recording amplifier 1 has an electronic switch which permits input of an FM signal to the amplifier only when the tape is actually running in the Record mode. The recording amplifier's frequency characteristics are adjusted to obtain optimum recording characteristics. In the Play mode, the amplifier's output is cut off by the electronic switch Q1. The recording amplifier 2 is a flat amplifier with SEPP circuit configuration. Its output is fed to the video heads via the preamplifier board and rotary transformer.

2. AGC (Automatic Gain Control) circuit

The keyed AGC system detects the amplitude of the sync component and adjusts the gain in order to obtain the required amplitude. An advantage of the keyed AGC design with respect to a peak detecting type AGC, is that it restores the video level to its intended original level. The basic principle is illustrated in Fig. 3-51, block diagram and corresponding waveforms.

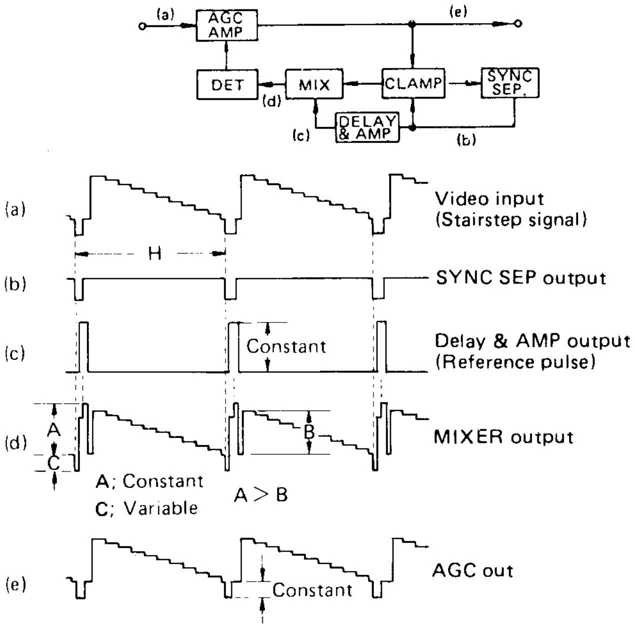


Fig. 3-51 AGC circuit

3.3.2 Luminance signal playback system

1. Signal Flow (Fig. 3-55)

In the Playback mode, Q1 on the preamplifier board is ON and Q2, Q3 are OFF. Thereby the playback signal from the video heads is fed to the preamplifier. After being amplified by the separate preamplifiers CH-1 and CH-2, the playback signal is joined into a continuous signal by a mixing circuit and electronic switch which is controlled by the drum flip-flop signal from the servo board. This signal is fed to the Y/C board from pin 8 of CN1. After passing through the emitter-follower Q4, the playback signal is separated into two lines. The first line goes to the color signal playback circuit, and the second line to IC3 for demodulation of the luminance signal. The output of Q4 is routed through a high-pass filter inside IC3, where the unnecessary lowband color signal is removed. Then an equalizer amplifier performs frequency compensation to obtain flat playback signal chracteristics. The output of the equalizer amplifier is fed to the FM AGC circuit of IC2 via EQ1. EQ1 serves especially to improve the start-up pulse characteristics. The AGC circuit is required to ensure correct operation of the following DOC (dropout compensator) circuit. Dropouts are due to imperfections in the tape, etc. and cause a momentary loss of FM signal. When this occurs, the DOC circuit inserts the FM signal from the previous horizontal scanning line (1 H), to produce a dropout-free FM signal. The DOC output is sent to the limiter circuit in IC6. The signal from IC3, pin 17 which passes the delay line DL1 and is separated into two lines. The one line goes to IC3 pin 18 for the DOC. The other line is sent to the noise cancel circuit.

The limiter circuit has a gain limit of approx. 80 dB, to permit correct operation of the demodulator and prevent black/white reversal.

The demodulator is a delay-type, phase-detecting detector. The demodulator output is sent to the low-pass filter LPF1 via the emitter-follower inside IC5. The detector output from the demodulator is integrated at LPF1 to become the demodulated original video signal. At the same time, FM carrier leak and the frequency range of the playback color signal is attenuated. EQ2 delays the luminance signal to match the timing of the color signal at the playback output. LPF1 and EQ2 serve to improve the pulse characteristics of the playback luminance signal. The output of EQ2 is supplied to IC1 pin 12. The 1 H delayed FM signal is also supplied from DL1 to IC1. IC1 forms the noise canceller circuit using horizontal correlation. During recording, the 25 Hz drum flipflop signal is supplied to the frequency modulator, shifting the CH-2 track 1/2 Fh with respect to the CH-1 track. By this, during playback, the crosstalk component from the adjacent track becomes 1/2 line offset relative to the main signal.

In the playback mode, by employing the above relationship, together with the correlation between video signal lines n and $(n - 1)$, and the random nature of the noise component, the noise component becomes reduced and

S/N improved. The output form IC1 pin 16 is returned to IC5, and the response in the 2-MHz vicinity is improved by an equalizer amplifier. The de-emphasis circuit restores the original frequency response by attenuating the high frequencies with characteristics opposite to those of the main emphasis circuit in the recording system. This serves to reduce the high-frequency noise inherent in frequency modulation. The level of the playback luminance signal is adjusted at R25 and via pin 5 of IC6, it is fed to the nonlinear deemphasis circuit. This circuit compensates for the nonlinear pre-emphasis applied during recording. A noise-limiter circuit attenuates high-frequency noise which includes carrier leak, and improves S/N ratio.

After the noise-limiter circuit, the signal passes a clamp circuit and a squelch circuit and then is combined with the playback color signal in the Y/C mixer circuit. This output appears at pin 31. During Shuttle Search and Still Playback, noise is introduced in the vertical sync signal which can disturb correct synchronization. In order to achieve stable synchronization, a v-pulse signal is supplied to pin 28 from the servo circuit and added to the squelch circuit.

The video signal from IC6, pin 31 is supplied to the video pulse equalizer IC12. The video pulse equalizers circuit serves to improve pulse response and reduce edge noise by introducing preshoot into regions of rapid transistion from black to white level, and from white to black level. The output goes to IC9 pin 6. Its sync tip is clamped by a clamp circuit, and then it is fed to the output amplifier. One output of the output amplifier is converted to low impedance by an emitter-follower, passes through R50, pin 2 of CN1 and the servo board, and is sent back to pin 1 of the camera connector mounted on the mechancon board. This is the picture signal for the viewfinder monitor on the camera. Because pin 1 serves for input as well as output, in the Recording mode (E-E mode) the output is cut by an electronic switch. The output signal during playback is fed out along with a DC voltage which serves for switching the viewfinder in the camera.

Another output from the output amplifier is of low impedance and branched into three lines from pin 9 of IC9. One line is fed from pin 6 of CN1 to the video output terminals on the servo board via a 75-ohm impedance. The second line goes via IC9 emitter-follower to Q7 emitter, while the third line is applied to the base of Q7 through EQ6. Q7 and Q8 form the electronic switch which selects the RF converter output. When the system select switch is set to "G", low appears at pin 4 of the RF converter and the signal via EQ6 is sent to the RF converter. When the switch is set to "I", pin 4 of RF converter becomes high, then the signal passing through IC9 is sent to the RF converter. The RF converter output is sent to the RF output terminal on the servo board.

2. Dropout compensator

Defects in the tape, such as magnetic particle losses, can cause loss or reduction of the FM signal, which may impair picture quality. When this occurs, the dropout compensator functions to insert the FM signal from the previous horizontal line, thereby preventing visible effects in the picture.

The FM AGC circuit first corrects for level fluctuations in the playback FM signal, which arise from variations in head to tape contact at the intake and outpout of the rotating drum. This result in a fixed level as indicated by waveform (b) in Fig. 3-52.

Part of this output goes directly to the switching circuit, while another part is applied to the dropout detector. In the dropout detector circuit, a highpass filter cuts the low side band of the FM signal and an integrator detects the dropout component. A precise squarewave is formed and supplied as waveform (c) to the switching circuit.

Part of DOC output is always supplied through a 1-H delay line (DL1) and an amplifier to the switching circuit. When a dropout occurs, the waveform (c) becomes high and the switcher turns on. The delayed FM signal becomes inserted in place of the dropout component.

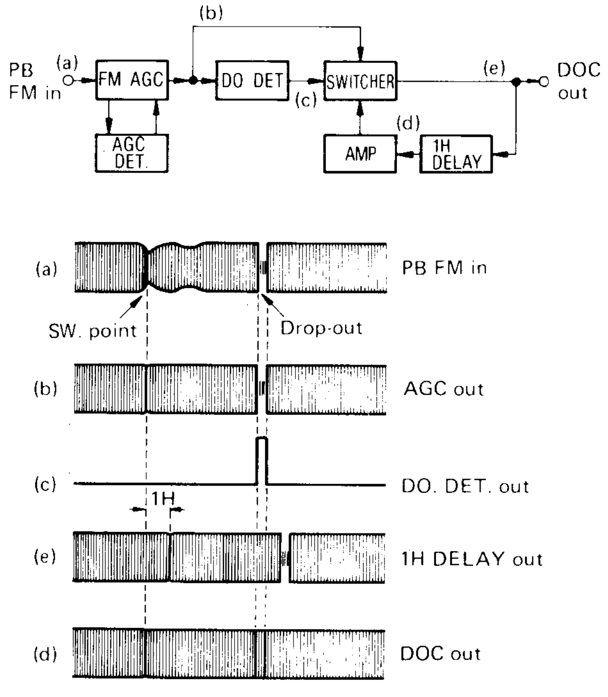


Fig. 3-52 Dropout compensator

3. Demodulator circuit

Part of the signal from the limiter goes directly to the switching circuit as the switching pulse. In the other route the signal goes through a delay circuit, then to the switcher as waveform (b) in Fig. 3-53.

The delayed output through the inverter enters the switcher as waveform (c).

A low switching pulse (a) produces the switching circuit output shown by (b), while a high pulse results in (c). Consequently, the switching circuit output becomes as shown by waveform (d). This is integrated through a lowpass filter to yield the luminance signal indicated by (e).

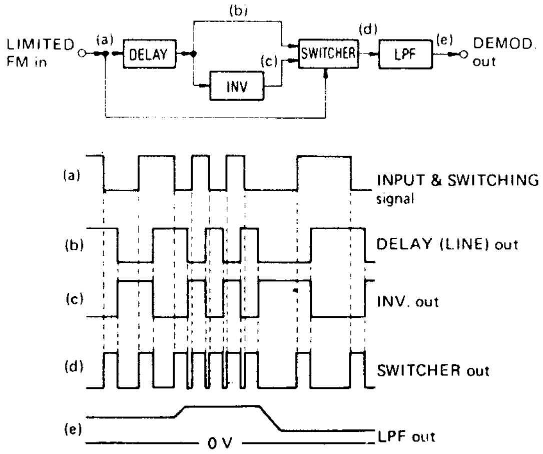


Fig. 3-53 Demodulator circuit

4. Noise Limiter circuit

P.B. signal reproduced from a recorded tape contains high frequency noise components. P.B. signal branches off in two ways; one to the mixing circuit directly and the other is sent to a high-pass filter that extracts its high frequency signal. As this high frequency signal contains the intelligence of rising-up and trailing of the signal, components whose levels are over the noise level is removed by the cripping circuit of the next step. Consequently, the waveform (c) is only of noise component, and then the waveform (d) of phase-converted will be added to the original P.B. signal at the mixing circuit to put out P.B. signal containing no noise signal.

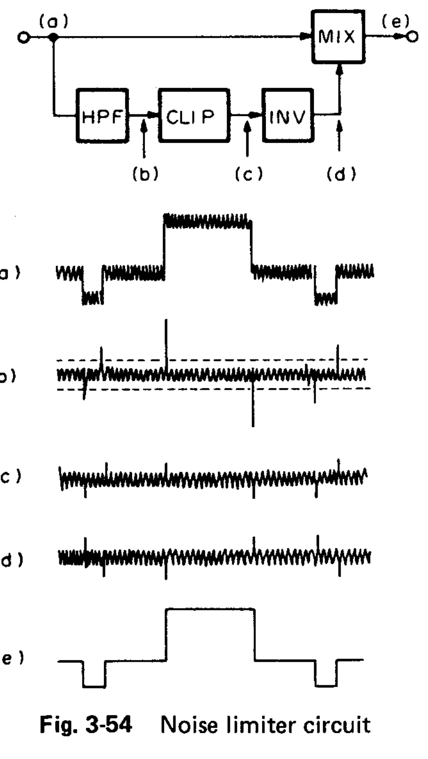


Fig. 3-54 Noise limiter circuit

3.3.3 Color signal recording system

1. Main Signal Flow (Fig. 3-56)

The video signal from the camera connector is divided into two lines at the Y/C board. One line goes to the AGC circuit of the luminance signal recording system in IC6. The other line is supplied to pin 16 of IC7.

In the Recording mode, the electronic switch is ON, and the input video signal passes the switch and is fed from pin 5 to the band-pass filter BPF1. Here the luminance signal is removed and only the chroma signal component with its main energy centered around the color subcarrier remains. This is fed to the ACC (automatic color control) amplifier via pin 8 of IC7. The ACC amplifier controls the level to achieve a constant burst level at the output. This output of the ACC amplifier is branched into two lines. One line goes to the ACC detector, the APC detector and the killer detector. At the ACC detector the burst signal is extracted with a burst gate pulse from a burst gate pulse generator, and this level is used to control the ACC amplifier. The other signal line is sent to a circuit block made up of main converter and killer amplifier. To this circuit block, the subconverter output, the killer detector output and the burst gate pulse are also supplied.

Therefore, the output signal is frequency converted with 4.43 MHz from the ACC amplifier and 5.06 MHz (Fs + 40fH + 1/8 fH) from the subconverter via BPF2. With a black-and-white signal, no output is obtained. This output signal contains the sum and difference signal components. It is sent via an electronic switch to the low-pass filter, where the difference signal component of 40 fH + 1/8 fH (627 kHz) only is extracted. This signal of 40 fH + 1/8 fH (627 kHz) goes to the emitter-follower inside IC7, the recording level is adjusted with R90, and then it is fed to IC2 pin 25. The adjusted signal is then mixed with the recording FM signal and supplied to the recording amplifier 1 of IC2. Signal flow from this point on is as described in the section on the luminance signal.

The subconverter performs frequency conversion with the 40-fH signal from the AFC loop and the Fs + 1/8 fH signal from the crystal oscillator X1. Because the subconverter output contains the sum and difference signal components, the band-pass filter BPF2 is used to separate the sum component of 5.06 MHz (Fs + 40 fH + 1/8 fH) and supply it to the main converter.

2. AFC (Automatic Frequency Control)

The AFC loop has the following 3 functions:

1) Generation of 40-fH signal (40 x 15.625 kHz - 625 kHz).
2) Phase shift of the 40-fH signal by 90° every 1H for CH-2.
3) Phase compensation with the horizontal sync signal.

The input video signal is sync separated at the sync signal separator circuit inside IC6 and the horizontal sync signal is sent to IC7, pin 3 from pin 26 of IC6. At the sync gate, the 1/2 H sync signal is cut off and only the H horizontal signal remains. This signal is sent to the burst gate pulse generator circuit and also to the phase shift circuit and the AFC detector circuit.

The AFC detector circuit is the phase comparator of the AFC loop. Its reference signal is the horizontal sync signal and its comparison signal is an fH signal gained by counting down the output of a 160-fH VCO (voltage-controlled oscillator) by 1/160. The VCO oscillates with 160 fH (160 x 15.625 kHz). The 160-fH signal is sent to a 1/4 count-down circuit and to a 1/160 count-down circuit. The signal counted down by 1/160 becomes the fH signal which is phase-compared in the AFC detector circuit with the horizontal sync signal of the input video signal. Because the horizontal sync signal used as reference is constant, the error output is also constant and the 160-fH VCO is controlled at R88 (AFC) to oscillate exactly with 160 fH. The signal counted down by 1/4 from the 160-fH signal becomes the 40-fH signal which is fed to the phase shift circuit. The drum flip-flop signal and the H sync signal are also fed to the phase shift circuit. Its output is 40 fH. Without shifting CH-1 head component, the CH-2 head component is delayed in phase 90° every line. This 40-fH signal is sent to the subconverter circuit as the AFC output.

3. APC (Automatic Phase Control)
The output from the ACC amplifier is also sent to the APC detector circuit. The APC detector circuit is the phase comparator of the APC loop. Its reference signal is the burst signal from the ACC output, and its comparison signal is the 4.433619 MHz VCO output. The phase error of these two signals with respect to the burst gate pulse is detected and resulting error voltage is fed to the 4.433619 MHz VCO. There by the VCO produces a 4.433619 MHz signal whose phase exactly matches that of the input color signal. This 4.433619 MHz signal is sent to the killer detector.

In the above manner, the APC loop does not function in the recording mode, since the REC burst signal phase is stable and nonfluctuating. The Fs + 1/8 fH signal from the crystal oscillator X1 is supplied to the subconverter.

3.3.4 Color signal playback system

1. Main Signal Flow (Fig. 3-56)
The playback signal is amplified at the preamplifier board and sent to the Y/C board from pin 8 of CN1 on the preamplifier board. Up to here, the signal flow is identical to the luminance signal playback system.

The playback signal is sent via Q4 to the luminance signal playback system on one hand, and to the low-pass filter LPF4 via a bias trap (C39, L14) on the other hand. The bias trap prevents leakage of the erase head current into the color signal playback system during audio dubbing. LPF4 attenuates the unnecessary luminance signal component and passes only the down converted color signal.

The timing of this playback color signal is matched to that of the playback luminance signal in EQ5. Then the playback color signal is sent to IC8 for amplification, and after amplification it is fed to the main converter. To the main converter the Fs + 40 fH + 1/8 fH signal from the subconverter is applied as in recording, and the output is the original 4.43 MHz component. However, the actual playback signal includes errors on the time axis (frequency and phase errors) due to tape speed variations, irregularities in video head rotation, tape elasticity, etc. Therefore the down-converted playback color burst signal becomes $Fsc' = 40\ fH' \pm 1/8\ fH' \pm \Delta f$. fH' is expressed by $fH \pm \Delta h$, which is frequency variation due to tape speed fluctuations. Large variations such as 40 fH' are compensated for by the frequency discriminator circuit, and small variations such as $\pm 1/8\ fH \pm \Delta f$, caused by rotational error of the video heads, tape elasticity, etc. are compensated for by the APC loop. These compensation signals control the 160-fH VCO and cause it to oscillate with $160\ fH' \pm 1/2\ \Delta h \pm 4\Delta f$. This output is counted down by 1/4 and becomes $40\ fH' \pm 1/8\ \Delta h \pm \Delta f$, which is sent to the phase shift circuit.

Corresponding to the recording process, the playback signal from CH-2 is phase-shifted (delayed) by 90° per 1H, and fed to the subconverter. As the subconverter receives a stable Fs + 1/8 fH (4.433571 MHz) signal from the crystal oscillator X1, the subconverter output becomes $(Fs + 40\ fH' + 1/8\ fH' \pm \Delta f)$ and $(Fs - 40\ fH' - 1/8\ fH' \mp \Delta f)$. At the band-pass filter BPF2 the $(Fs + 40\ fH' + 1/8\ fH' \pm \Delta f)$ component is extracted and sent to the main converter. Therefore, the main converter output becomes the sum and difference signal of the playback color signal of $40\ fH' + 1/8\ fH' \pm \Delta f$ and the output from BPF2 $(Fs + 40\ fH' + 1/8\ fH' \pm \Delta f)$. By passing this output through the band-pass filter BPF1, the difference signal of Fs (4.43 MHz) only, that is a stable color signal without phase or frequency errors, is obtained.

This playback color signal is then fed to the ACC amplifier. After the burst level is fixed by the ACC, the ACC output is sent to the killer amplifier which performs killer action according to the output from the killer detector.

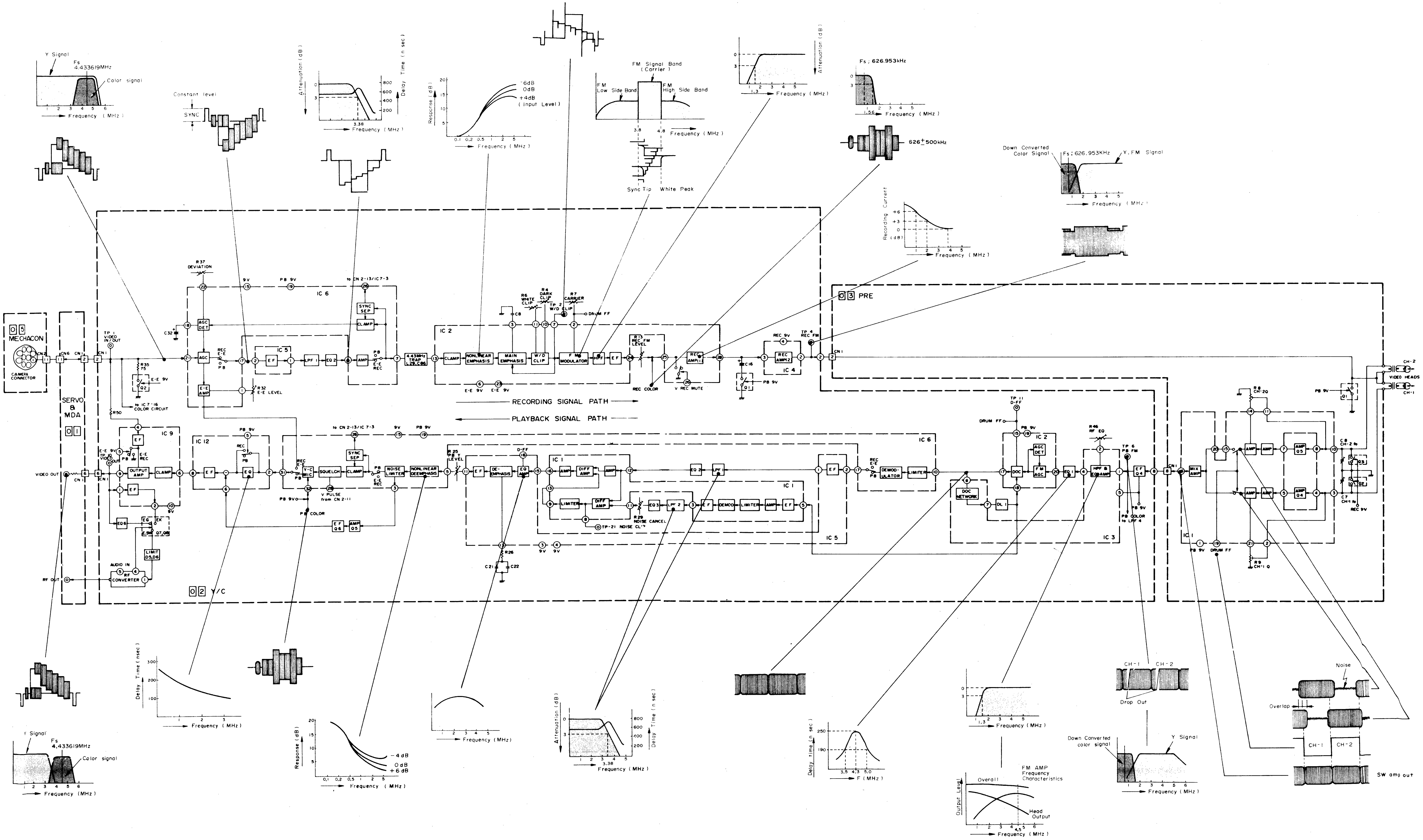

Y Signal
Fs 4.433619MHz
Color signal
Frequency (MHz)
Constant level
SYNC
Attenuation (dB)
Delay Time (n sec)
3.38
Response (dB)
-6dB
0dB
+4dB
(Input Level)
FM Signal Band (Carrier)
FM Low Side Band
FM High Side Band
3.8
4.8
Sync Tip
White Peak
Fs ; 626.953kHz
626±500kHz
Down Converted Color Signal
Y.FM Signal
Recording Current (dB)
05 MECHACON
CAMERA CONNECTOR
SERVO & MDA
01
IC 6
IC 5
IC 2
IC 4
IC 9
IC 12
IC 1
IC 3
R37 DEVIATION
AGC DET
AGC
E-E AMP
SYNC SEP
CLAMP
EF
LPF 1
EQ 2
AMP
4.43MHz TRAP
NONLINEAR EMPHASIS
MAIN EMPHASIS
W/D CLIP
FM MODULATOR
HPF
REC AMP 1
REC AMP 2
R6 WHITE CLIP
R4 DARK CLIP
R7 CARRIER
TP 2 W/D CLIP
TP 4 REC FM
03 PRE
VIDEO HEADS
CH-1
CH-2
RECORDING SIGNAL PATH
PLAYBACK SIGNAL PATH
VIDEO OUT
RF OUT
AUDIO IN
RF CONVERTER
OUTPUT AMP
EQ
Y-C MIX
SQUELCH
NOISE LIMITER
NONLINEAR DEEMPHASIS
DE-EMPHASIS
DIFF AMP
LIMITER
DEMOD
R29 NOISE CANCEL
TP-21 NOISE CANCEL
DEMODULATOR
DOC
DOC NETWORK
DL 1
FM AGC
HPF & EQ AMP
R46 RF EQ
TP 6 PB FM
MIX AMP
02 Y/C
Drop Out
Overlap
Noise
SW amp out
FM AMP Frequency Characteristics
Overall
Head Output
Output Level
Delay time (n sec)
250
190
3.5
4.3
5.0
F (MHz)
-4dB
0dB
+6dB

Fig. 3-55 Luminance signal block diagram

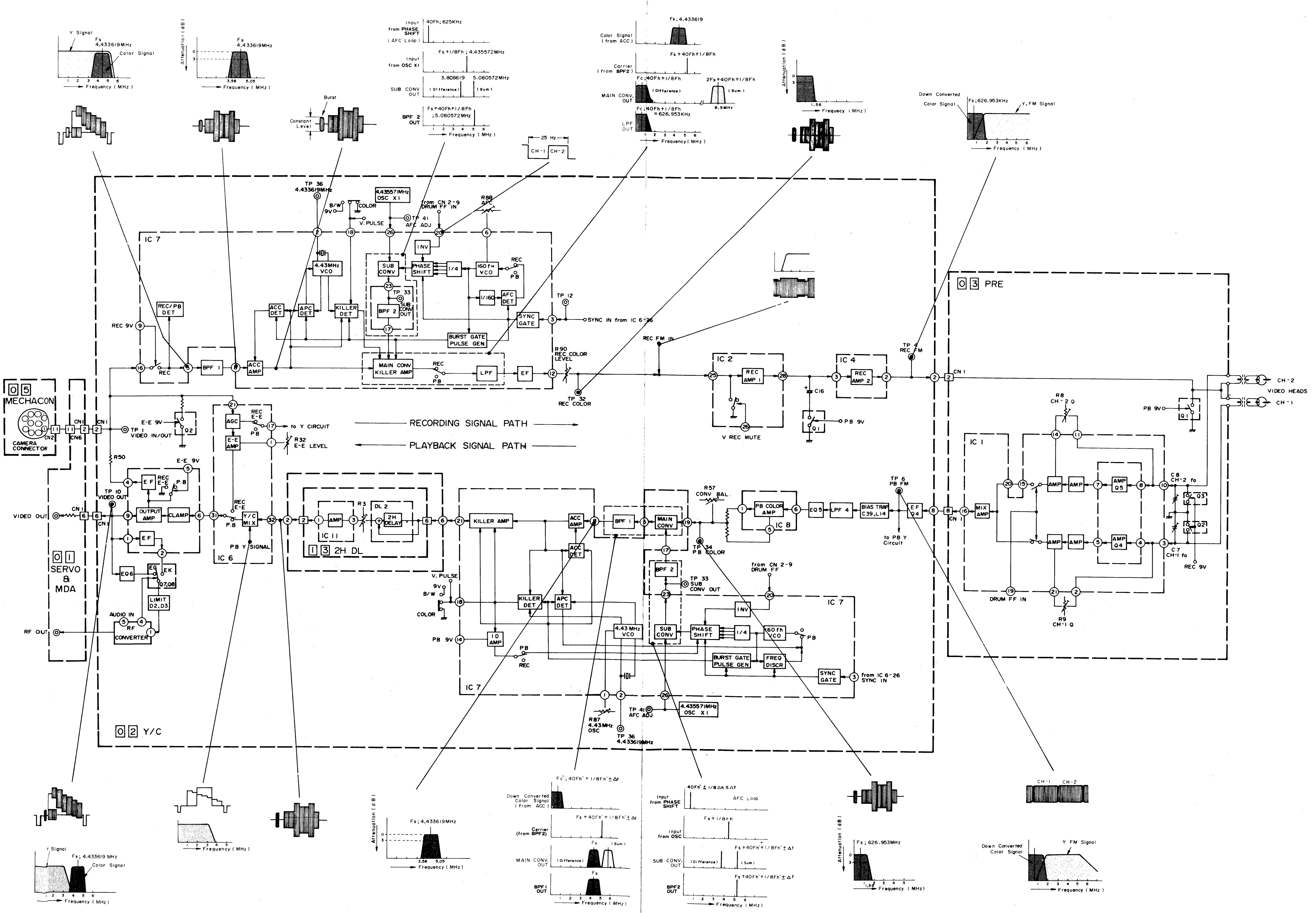

05 MECHACON
CAMERA CONNECTOR
CN2
CN1
CN6
01 SERVO & MDA
VIDEO OUT
RF OUT
AUDIO IN
RF CONVERTER
02 Y/C
IC 7
IC 6
REC 9V
REC/PB DET
REC
BPF 1
ACC AMP
ACC DET
APC DET
KILLER DET
4.43MHz VCO
4.435571MHz OSC X1
TP 36 4.433619MHz
B/W
COLOR
9V
V. PULSE
TP 41 AFC ADJ
from CN 2-9 DRUM FF IN
R88 APC
INV
SUB CONV
PHASE SHIFT
1/4
160 fH VCO
1/160
AFC DET
TP 33 SUB CONV OUT
BPF 2
BURST GATE PULSE GEN
SYNC GATE
TP 12
SYNC IN from IC 6-26
MAIN CONV KILLER AMP
PB
LPF
EF
R90 REC COLOR LEVEL
TP 32 REC COLOR
E-E 9V
TP 1 VIDEO IN/OUT
Q2
AGC
E-E AMP
REC E-E
to Y CIRCUIT
R32 E-E LEVEL
RECORDING SIGNAL PATH
PLAYBACK SIGNAL PATH
R50
TP 10 VIDEO OUT
OUTPUT AMP
CLAMP
EQ6
EQ EK
Q7,Q8
LIMIT D2,D3
Y/C MIX
PB Y SIGNAL
IC 11
AMP
R3
DL 2
2H DELAY
13 2H DL
KILLER AMP
ACC AMP
ACC DET
KILLER DET
APC DET
V. PULSE
PB 9V
ID AMP
R87 4.43MHz OSC
TP 36 4.433619MHz
4.435571MHz OSC X1
BPF 1
MAIN CONV
BPF 2
TP 33 SUB CONV OUT
TP 34 PB COLOR
R57 CONV BAL.
PB COLOR AMP
IC 8
EQ5
LPF 4
BIAS TRAP C39, L14
EF Q4
to PB Y Circuit
from CN 2-9 DRUM FF
INV
160 fH VCO
FREQ DISCR
from IC 6-26 SYNC IN
REC FM IN
IC 2
REC AMP 1
V REC MUTE
C16
Q1
PB 9V
IC 4
REC AMP 2
TP 9 REC FM
TP 6 PB FM
03 PRE
CN 1
CH-2
VIDEO HEADS
CH-1
PB 9V
R8 CH-2 Q
IC 1
MIX AMP
AMP
AMP Q5
AMP Q4
C8 CH-2 fo
C7 CH-1 fo
Q3
Q2
REC 9V
DRUM FF IN
R9 CH-1 Q
Y Signal
Fs 4.433619MHz
Color Signal
Frequency (MHz)
Attenuation (dB)
3.58 5.05
Burst
Constant Level
Input from PHASE SHIFT (AFC Loop)
40Fh; 625KHz
Input from OSC X1
Fs+1/8Fh; 4.435572MHz
SUB CONV OUT
3.808619 5.060572MHz
(Difference) (Sum)
BPF 2 OUT
Fs+40Fh+1/8Fh ; 5.060572MHz
25 Hz
CH-1 CH-2
Color Signal (from ACC)
Fs; 4.433619
Carrier (from BPF2)
Fs+40Fh+1/8Fh
MAIN CONV. OUT
Fc; 40Fh+1/8Fh
2Fs+40Fh+1/8Fh
9.5MHz
LPF OUT
Fc; 40Fh+1/8Fh =626.953KHz
1.56
Down Converted Color Signal
Fs; 626.953KHz
Y, FM Signal
Fs; 4.433619MHz
Down Converted Color Signal (from ACC)
Fc'; 40Fh'+1/8Fh'±Δf
Carrier (from BPF2)
Fs+40Fh'+1/8Fh'±Δf
MAIN CONV. OUT
Fs (Sum)
BPF1 OUT
Input from PHASE SHIFT
40Fh'±1/8Δh±Δf
AFC Loop
Input from OSC
Fs+1/8Fh
SUB CONV. OUT
Fs+40Fh'+1/8Fh'±Δf
BPF2 OUT
Fs; 626.953MHz
Y FM Signal

Fig. 3-56 Color signal block diagram

The color output appears at IC7 pin 21 and is supplied to the 2H delay line board. The 2H delayed and bypassed signals are mixed for cancelling color crosstalk. R3 adjusts the playback color level.
After amplified by IC11, the color signal is returned to Y/C board.

In a mixer circuit, this signal is mixed with the luminance signal and becomes the playback video signal. The signal flow from this point on is the same as for the luminance signal playback system.

2. Frequency Discriminator circuit
Fig. 3-57 shows the block diagram and the property of the frequency discriminator circuit.

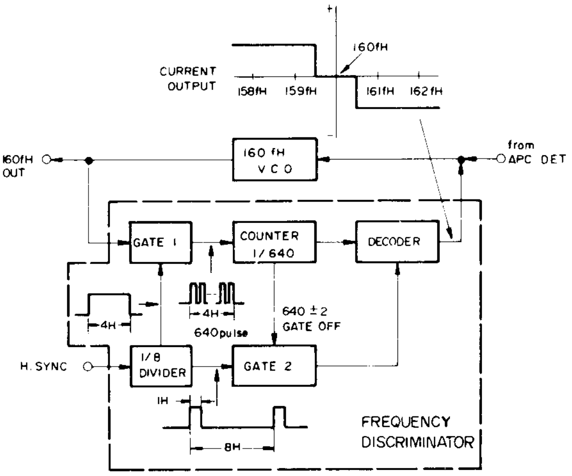


Fig. 3-57 Frequency discriminator circuit

The frequency discriminator circuit counts VCO output of 160 fH, and if the frequency becomes different by ±1/2 fH or more from the normal, this circuit puts out a signal to control 160 fH VCO output. In practice it counts 160 fH VCO of 4H period and 160 fH is equal to 640 pulses and 1/2 fH is 2 pulses. 160 fH VCO output is sent to the counter circuit through the gate 1 for the periof of 4H. The gate 1 is also supplied with 4H gate pulse from the 1/8 divider circuit. The number of pulse for this 4H period is 640 ± n.

The counter circuit counts 640 ± n pulses of 4H period and puts out 2 kinds of signals. One is output of Low or High potential to be supplied to the decoder circuit and the potential is High when the number of pulses is more than 640 while Low in less than 640. The other is gate pulse to be supplied to the gate 2, and it also has two kinds of potential of H and L; H is in case of 640 ± 2 (638–642) pulses and L in other case. The gate 2 puts out the pulse of the 1/8 divider circuit to the decoder circuit when the gate pulse from the counter circuit is Low. Namely, this pulse operates the decoder circuit for 1H duration at intervals of 8H period. Consequently, as shown in Fig. 3-57, the output of the decoder is 3-value output; zero when the number of pulse is 640 ± 2 (160 ± 1/2 fH), when it is less than 638 (159.5 fH) the output is to be able to increase oscillation frequency of 160 fH VCO, while in case of more than 642 (160.5 fH) the output is to decrease the frequency. When the output is zero APC loop corrects it.

3. APC circuit
The phase comparator circuit is supplied with 4.43 MHz crystal oscillator output as the reference signal and P.B. color signal including phase deviation as the comparison signal. The error voltage is sent to 160 fH VCO to control it with the output of the frequency discriminator circuit.

3.4 AUDIO CIRCUIT

3.4.1 Outline

This model performs monaural audio recording and playback. Since the main portion of the audio system is contained within IC devices, composition becomes highly simplified.

Two audio inputs are provided: camera and microphone, with priority to the microphone input. Audio outputs are in four lines: line, RF, earphone jack and camera. If the earphone jack is employed, the output to the camera connector becomes inhibited.

The full erase head uses a special oscillator, which is mounted to the head.

3.4.2 Recording signal flow

Both audio input lines are routed to the mechacon board. The −20 dBs signal from the camera connector is attenuated to −67 dBs by mechacon board R4 and R5, then sent via the microphone jack to the audio board. When a microphone is connected, the signal from the camera connector becomes cutoff and the microphone signal goes to the audio board.

The audio signal from the mechacon board is amplified 35 dB by the microphone amplifier of IC1. R1 adjusts this signal to −6 dBs at the audio output terminal, which goes to the recording line amplifier. The signal is amplified 19 dB and after lowpass filter L1, it is branched into two lines.

The first goes via IC1 pin 20 to the output amplifier, where it is amplified 30 dB to 0 dBs. This is sent to the AGC circuit, and at the same time, from pin 18 and CN5 pin 9 to the servo board as the audio output.

At the servo board, the signal is distributed to a) the RF converter of the Y/C board, b) the audio output jack at −6 dBs through a resistance divider, and c) the earphone jack and camera connector via the mechacon board. When an earphone is connected, the signal to the camera connector becomes cutoff.

In the other signal route from L1, R4 adjusts the recording level and the signal goes via IC1 pin 21 to the recording amplifier. R16, L2 and C33 of the recording equalizer boost the 11 kHz region by about 10 dB. The recording amplifier output is then mixed with bias and sent from CN2 pin 2 to the audio head.

R21 adjusts the level of the bias signal obtained from the IC2 and L4 oscillator circuit. When low potential appears at pin 3 of IC2, oscillation is performed at approximately 65 kHz. The oscillator output is also supplied to the audio erase head.

The same IC is employed for the full erase head oscillator, which also functions when low appears at pin 3.

3.4.3 Playback signal flow

The signal picked up by the audio head goes via IC1 pin 1 to the playback equalizer amplifier, where it is amplified 30 dB. Equalization is performed by using negative feedback between pins 2 and 4.

The cancel signal from the servo board through CN5 pin 6 appears at IC1 pin 2. This serves to prevent the audio head from picking up the drum motor drive signal.

R15 adjusts the playback level of the pin 4 output signal. At the playback line amplifier, the signal is amplified 19 dB and appears at the pin 22 output. Afterwards, signal flow is the same as for recording, with the exception that the recording amplifier does not function.

3.4.4 Control circuit

The audio board also includes the control circuit. Potential at pin 6 sets IC1 for the recording or playback mode. When pin 6 is Vcc potential, the mode is playback, 1/2 Vcc yields the E-E mode, and low (ground) potential produces the recording mode.

Muting is controlled by IC1 pin 7. Low (ground) potential at pin 7 mutes the output and recording amplifiers.

Electronic switch IC3 selects the audio head mode. Low (ground) potential at pin 5 sets the recording mode.

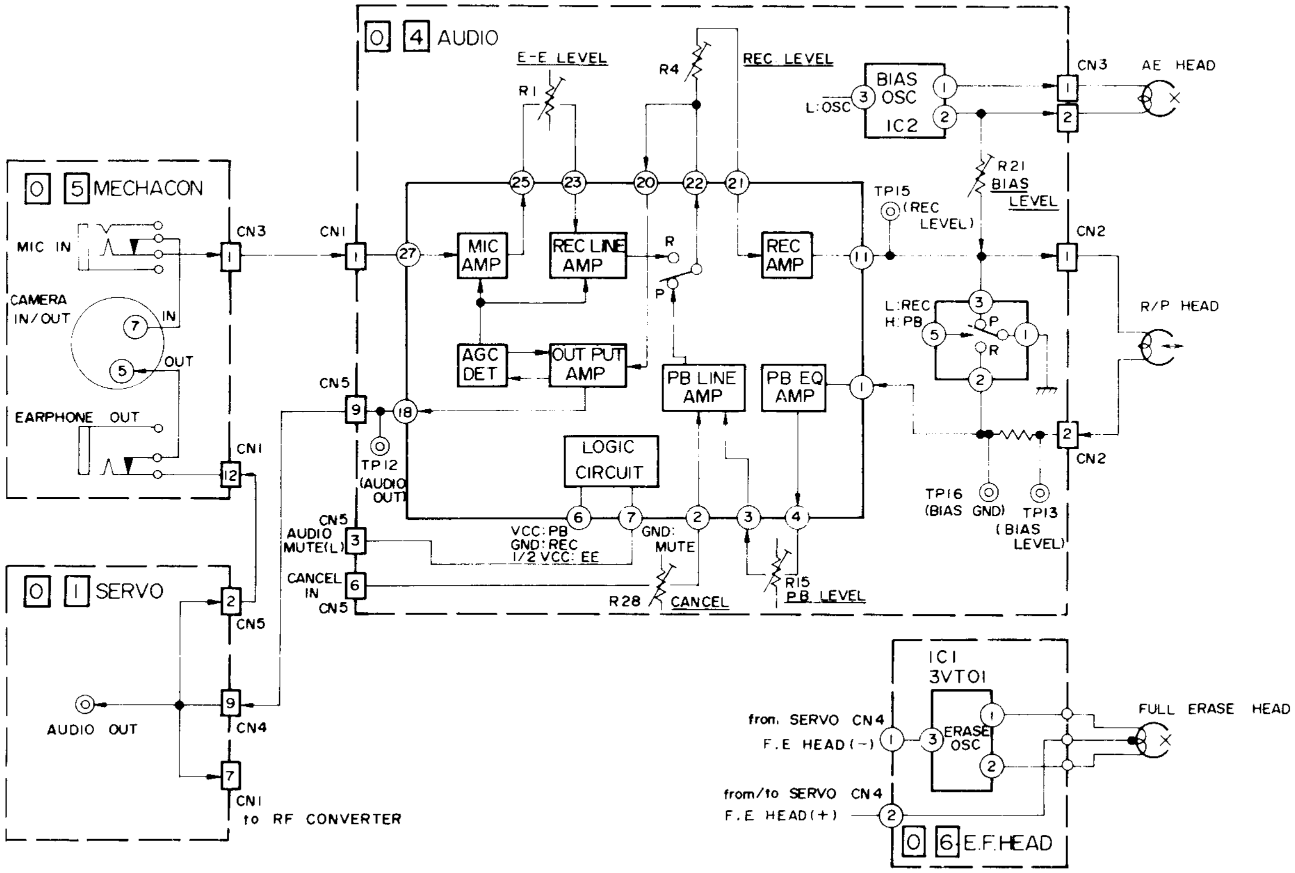

0 4 AUDIO
E-E LEVEL
R1
R4
REC LEVEL
BIAS OSC
L:OSC
IC2
CN3
AE HEAD
0 5 MECHACON
MIC IN
CAMERA IN/OUT
IN
OUT
EARPHONE OUT
CN3
CN1
CN1
25
23
20
22
21
27
MIC AMP
REC LINE AMP
R
P
REC AMP
11
TP15 (REC LEVEL)
R21 BIAS LEVEL
CN2
R/P HEAD
L:REC
H:PB
AGC DET
OUT PUT AMP
PB LINE AMP
PB EQ AMP
CN5
18
TP12 (AUDIO OUT)
LOGIC CIRCUIT
VCC:PB
GND:REC
1/2 VCC: EE
GND: MUTE
CN5 AUDIO MUTE(L)
CANCEL IN CN5
R28 CANCEL
R15 PB LEVEL
TP16 (BIAS GND)
TP13 (BIAS LEVEL)
CN2
0 1 SERVO
CN5
AUDIO OUT
CN4
CN1 to RF CONVERTER
IC1 3VT01
ERASE OSC
from SERVO CN4 F.E HEAD(−)
from/to SERVO CN4 F.E HEAD(+)
FULL ERASE HEAD
0 6 E.F.HEAD

Fig. 3-58 Audio block diagram

SECTION 4
MECHANICAL ADJUSTMENT

4.1 GENERAL

4.1.1 Precautions

IMPORTANT:

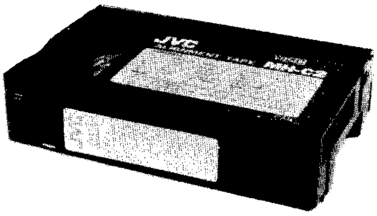
1. Disconnect from power before removing or soldering components.
2. When removing a screw from the chassis, be careful not to drop it into the mechanism. If a screw should be dropped, be sure to retrieve it.
3. Be extremely careful not to damage either the upper or lower head drum assemblies.
4. The tape transport mechanism has been precisely adjusted at the factory and ordinarily does not require readjustment.
5. When removing a part, be very careful not to damage or displace other parts. (Be especially careful with the guide poles and rotary video head drum.)
6. To operate the set with the cassette housing removed, close or short the terminals of the cassette switch. Also disable the photo transistor sensor by applying opaque cover. After completing checks and repairs, be sure to remove the covers.

4.1.2 Required jigs and tools

A: For proper mechanical adjustment, the following jigs and tools are strongly recommended. Without them, a long trial-and-error period would be necessary.

In addition, general-purpose tools and a metric hex key (not supplied by JVC) are required.
The hex key needed for this model is 1.5 mm size.

JVC Alignment Tape MH-C2



Tension arm tool PUJ43532-2

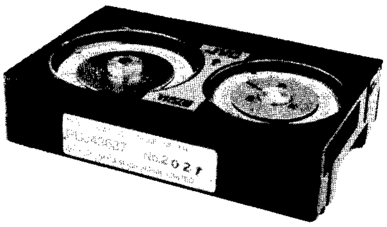
Cassette cover tool PUJ43638

A/C head position tool PUJ47351-2

Patch cord set PUJ36480B

Allow circuit boards to be separated from chassis for more convenient checking and adjustments.

Cassette torque meter PUJ43637



Height gauge PUJ43545

Table 4-1 Jigs and tools for mechanical adjustment

NOTE: See section 5.1.1 Required test equipment and jigs regarding electrical adjustment.

4.2 DISASSEMBLY

4.2.1 External covers

1. Slide the eject knob downward to raise the cassette housing.

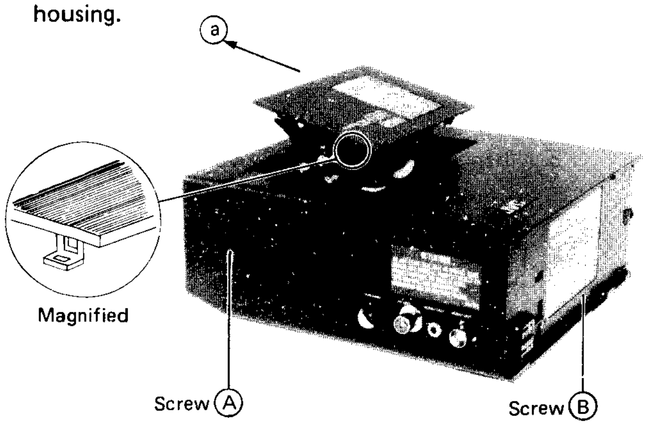

ⓐ
Magnified
ScrewⒶ
ScrewⒷ

Fig. 4-1

2. Spread the two cassette cover tabs (1 each left and right) outward and remove the cover in the directionⓐ.
3. Take out two screws Ⓐ and remove the front cover.
4. Take out one screw Ⓑ . Slightly spread the forward portion of the top cover assembly and pull the assembly upward to remove. Use care not to damage the battery terminals.
5. Take out two screws Ⓒ (1 each left and right) and remove the bottom cover.

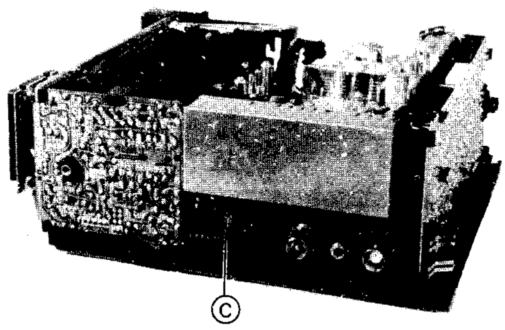


Fig. 4-2

NOTE: If the cassette housing cannot be raised, remove the external covers in the following manner.

1) The cassette cover is secured with four tabs as shown below.

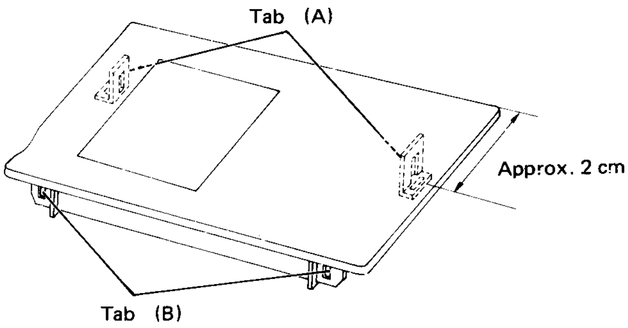

Tab (A)
Approx. 2 cm
Tab (B)

Fig. 4-3

2) Insert the cassette cover tool obliquely between the external covers as shown in the figure. Use care not to damage the covers.

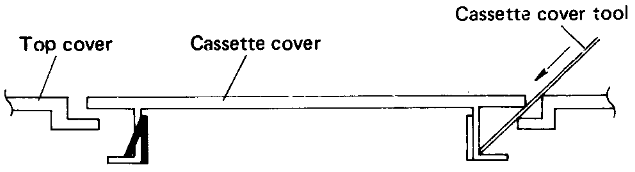

Cassette cover tool
Top cover
Cassette cover

Fig. 4-4

3) Carefully pry the tabs (A) free as indicated in Fig. 4-5.
4) Disengage tabs (B) and remove the cassette cover.
5) Remove the external covers; refer to Item 4.2.1.

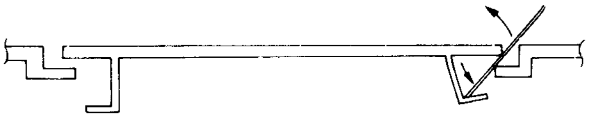


Fig. 4-5

4.2.2 Circuit board assemblies

If necessary to remove the servo & MDA board, first remove the Y/C, Switching Regulator, Audio and Mechacon boards.

Note: The circuit boards are connected by connectors. When removing, use care not to bend the boards, as this may cause faulty contact.

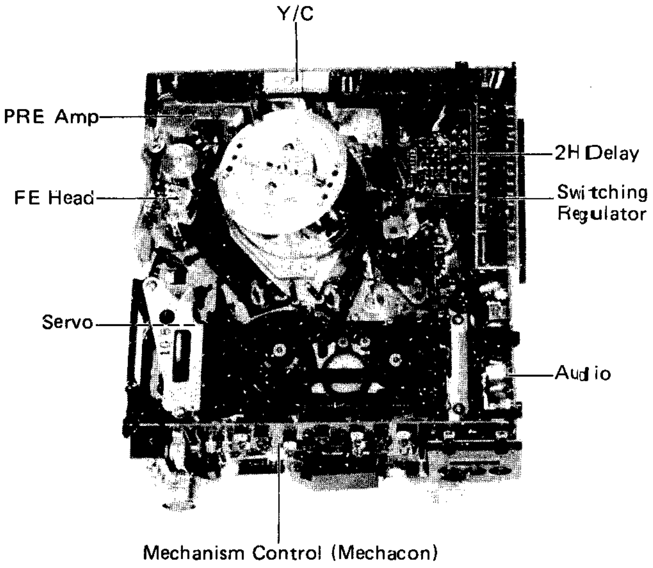

Y/C
PRE Amp
FE Head
Servo
2H Delay
Switching Regulator
Audio
Mechanism Control (Mechacon)

Fig. 4-6

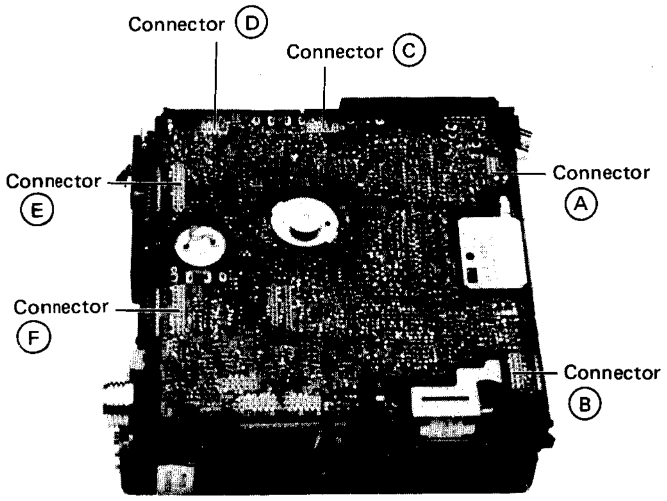

Connector Ⓓ
Connector Ⓒ
Connector Ⓔ
Connector Ⓐ
Connector Ⓕ
Connector Ⓑ

Fig. 4-7

1. 02 Y/C board
   Disengage hooks ⓐ and ⓑ indicated in Fig. 4-6.
   Disconnect connectors Ⓐ and Ⓑ, and remove the Y/C board.
2. 10 Switching Regulator board
   Disconnect connector Ⓒ and remove the Switching Regulator board. (Fig. 4-7)
3. 04 Audio board
   Disengage hook ⓒ shown in Fig. 4-6.
   Disconnect connector Ⓓ and remove the Audio board. (Fig. 4-7)
4. 05 Mechacon board
   Take out two screws ⓕ of the camera connector. (Fig. 4-6)
   Disengage hooks ⓓ and ⓔ.
   Disconnect connectors Ⓔ and Ⓕ, and remove the Mechacon board. (Fig. 4-7)
5. 01 Servo & MDA board
   Disconnect connectors Ⓖ and Ⓗ.
   Remove the Servo & MDA board. (Fig. 4-8)

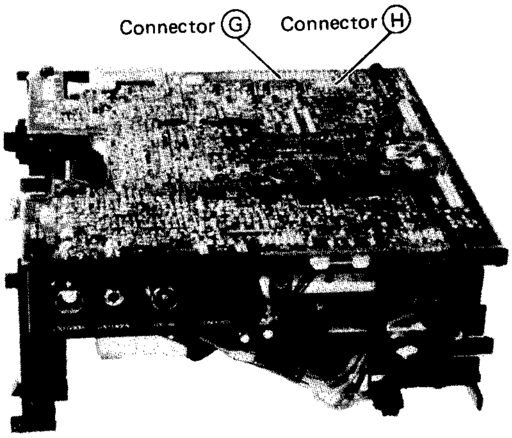

Connector Ⓖ
Connector Ⓗ

Fig. 4-8

6. 03 Pre-amp board
   1) Take out one screw Ⓐ and remove the shield plate.
      Disconnect the connector with the flexible cable. (Fig. 4-9)
      Detach the flexible cable from the shield case. At this time use care not to damage the flexible cable.
   2) Unsolder the points shown in Fig. 4-9 and remove the shield case.

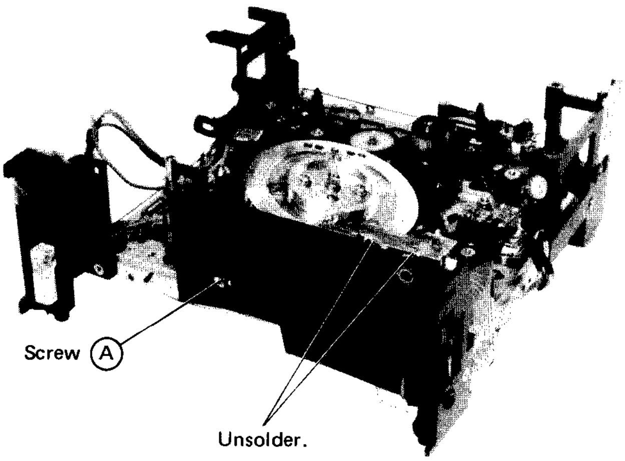

Screw Ⓐ
Unsolder.

Fig. 4-9

   3) Take out one screw Ⓑ and remove the Pre-amp board.

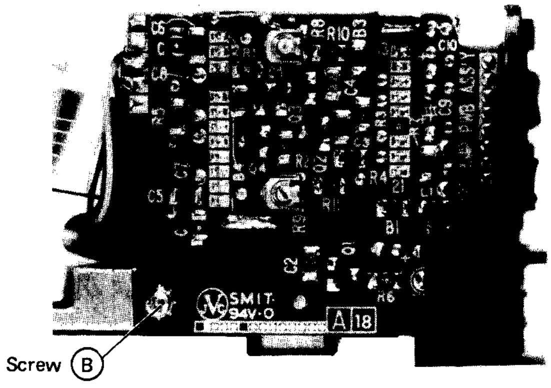


Fig. 4-10

4.3 LAYOUT OF MAIN MECHANICAL PARTS

4.3.1 Top view and parts identification

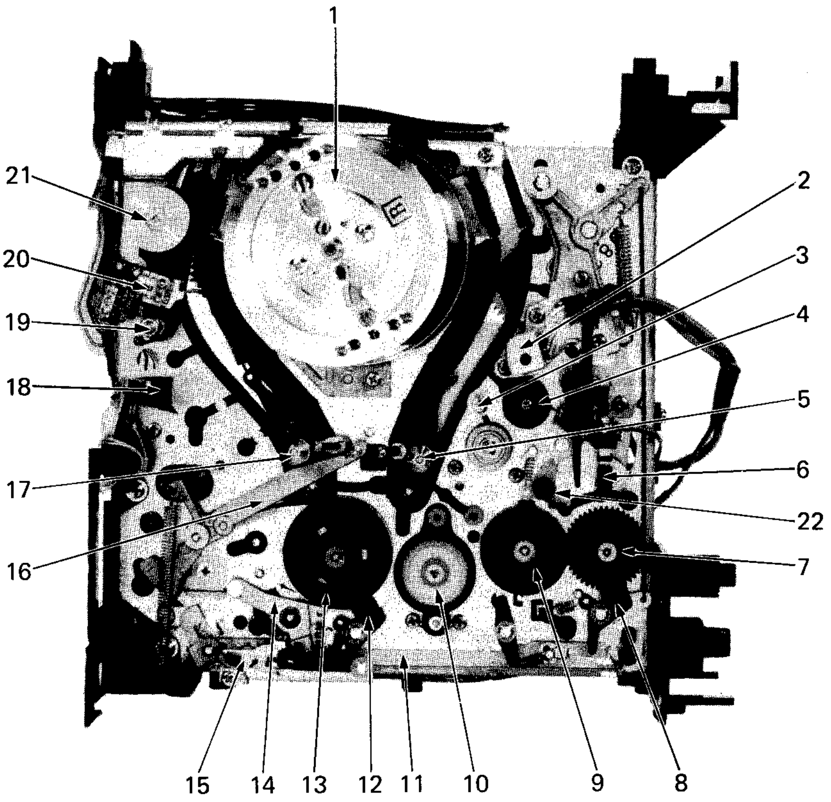


Fig. 4-11 Top view

Symbol No.	Part Name	Part No.
1	Upper Drum Assembly	PU33620B
2	Audio/Control Head	PU54395
3	Tape Guide	PU53629-2
4	Pinch Roller Assembly	PU54739A
5	Take-up Guide Roller Ass'y	PU53046A
6	Cassette Switch	PU52732
7	Take-up Gear	PU52991
8	Take-up Brake Arm Ass'y	PU53012A
9	Take-up Pulley	PU52992
10	Idler Arm	PU52990
11	Slide Lever Ass'y	PU53002B
12	Supply Brake Arm Ass'y	PU53015A
13	Supply Reel Disk	PU53000
14	Cancel Lever Ass'y	PU53017A
15	REC Safety Switch	PU53083
16	Tension Arm Ass'y	PU52997A
17	Supply Pole Base Ass'y	PU53044A
18	Dew Sensor	PU53091
19	Guide Pole	PU53058
20	Full Erase Head	PU54397
21	Roller Ass'y	PU54742A
22	Tension Brake Ass'y	PU54198A

Table 4-2

4.3.2 Bottom view and parts identification

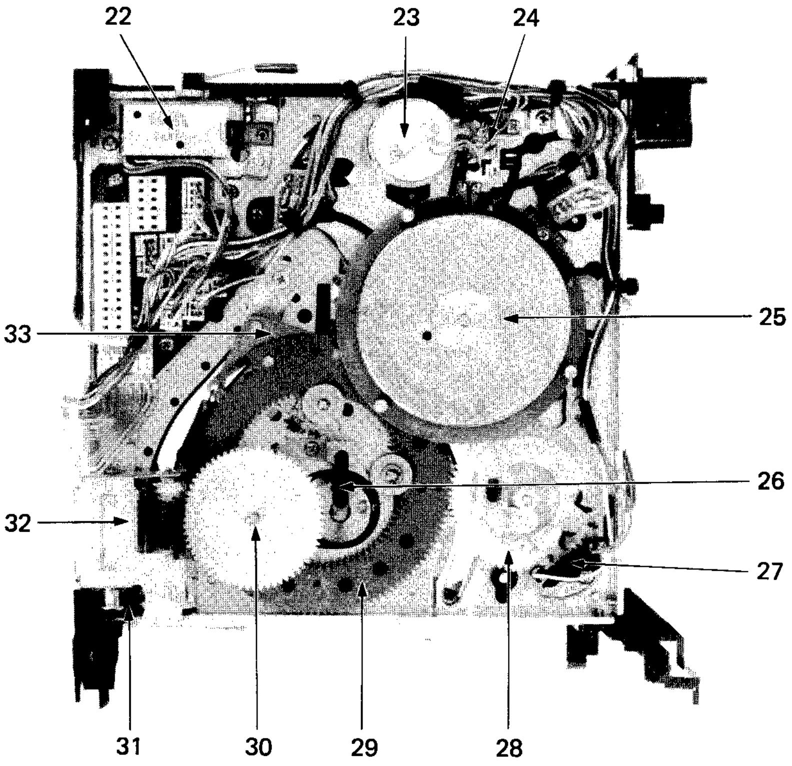


Fig. 4-12 Bottom view

Symbol No.	Part Name	Part No.
22	Brake Solenoid	PU53004
23	Reel Motor Ass'y	PU53585V
24	Solenoid Switch	PU53083
25	Capstan Motor	PU53066V
26	Brush	PU53092
27	Loading Switch	PU53088
28	Cam Gear	PU33551-2
29	Drive Ring Ass'y (L)	PU53024A
30	Worm Wheel Ass'y	PU53036A
31	Loading Belt	PUM30003-6
32	Loading Motor	PU53039V
33	Drive Ring Ass'y (R)	PU53021C

Table 4-3

4.4 PERIODIC MAINTENANCE

The following procedures are recommended for maintaining optimum performance and reliability of this video cassette recorder.

4.4.1 Cleaning

For cleaning, use a lint-free cloth or gauze dampened with alcohol.

A: Tape transport system

1. The following components should be cleaned after every 500 hours of use.
   1) Tension pole
   2) Supply guide pole
   3) Full erase head
   4) Supply impedance roller
   5) Supply guide roller
   6) Supply slant pole
   7) Video head and Drum system
   8) Brush
   9) Take-up slant pole
   10) Take-up guide roller
   11) Audio/control head and Audio erase head
   12) Tape guide
   13) Pinch roller
   14) Capstan
2. Since above parts come in direct contact with video tape, they tend to collect dust particles. If allowed to accumulate, dust may lead to damage to the video tape and above parts.
3. After cleaning with alcohol, allow the parts to dry thoroughly before using a cassette tape.

   NOTE:
   When cleaning the video heads on the upper drum, do not clean them with a vertical stroke.
   Use only a gentle back and forth motion in the direction of the tape path.
   Use care since they are easily damaged.
   When cleaning video heads, A/C head and erase heads, use a lint-free cloth dampened with alcohol.

B: Reel drive system

1. The following components should be cleaned after every 1,000 hours of use.

   – Upper section –
   1) Reel motor
   2) Reel idler
   3) Supply reel disk
   4) Supply main brake
   5) Take-up gear
   6) Take-up main brake
   7) Take-up pulley
   8) Idler arm

   – Bottom section –
   9) Loading gear
   10) Loading belt
   11) Loading motor
2. The above revolving parts are of rubber or come in direct contact with rubber parts.
   Rubber dust can accumulate and interfere with proper operation.
3. Avoid using excessive alcohol when cleaning rubber parts.

4.4.2 Lubrication

The following components should be lubricated with JVC oil after every 2,000 hours of use.

1) Shaft of the supply reel disk

After cleaning above shaft with alcohol, lubricate these shafts with one or two drops of JVC oil.
Do not over lubricate.

4.4.3 Service schedule for main components

The following chart lists the parts of the units which should receive periodic servicing at the recommended intervals.

Part Name	Part No.	Periodic Service Schedule (operating hours)				
		1 000	2 000	3 000	4 000	5 000
Upper Drum Assembly	PU33620B	●	●	●	●	●
Take-up Pulley Assembly	PU52992		●		●	
Reel Motor Assembly	PU53585V		●		●	
Capstan Motor Assembly	PU53066V		●		●	
Idler Arm Assembly	PU52990		●		●	
Take-up Gear	PU52991		●		●	
Tension Band Assembly	PU52993A		●		●	
Brush Assembly	PU53902		●		●	
Loading Belt	PUM30003-6		●		●	
Tension Brake Ass'y	PU54198A		●		●	
A/C Head Assembly	PU54395			●		
Pinch Roller Assembly	PU54739A			●		
Loading Motor	PU53039V			●		
Supply Reel Disk Assembly	PU53000			●		
Full Erase Head	PU54397					●

Table 4-4 Standard service periods

● Replace.

NOTE:
Even if the unit is not used frequently, cleaning, lubrication and replacement of the belts should be undertaken every 2 years.

4.5 MAIN ASSEMBLY REPLACEMENTS

4.5.1 Cassette housing

1. With the cassette housing lowered, remove four screws (A) (2 each right and left).
2. Depress the eject lever to raise the cassette housing.
3. Because in this condition the eject lever still sticks through the rectangular cut-out in the mechacon board, the lever is caught by the board and prevents the cassette housing from being removed.
4. To remove the cassette housing, first lift it up in the rear and tilt it outwards to lift it off.
5. To reinstall the cassette housing, insert the eject lever from the left into the rectangular cutout in the mechacon board and place the cassette housing onto the set in the raised position.
6. At this time, make sure that the guides of the cassette housing bracket are firmly engaged in the rectangular cut-outs on the main deck.
7. Lower the cassette housing until it locks in place.
8. While lightly pulling the cassette housing arm, insert the four screws and tighten them in the order (a), (b), (c), and (d).
9. Insert a cassette tape and check that it can be set smoothly, is held firmly in place in the lowered position with no front/back, left/right or up/down instability, etc.

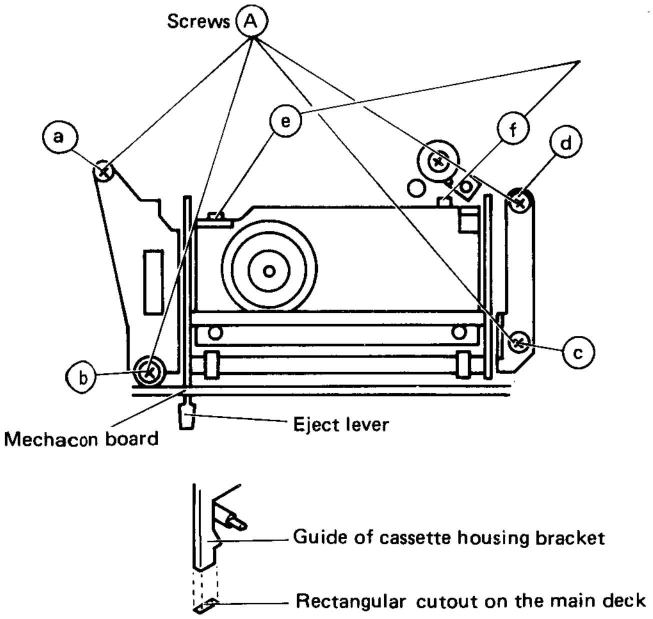

Screws Ⓐ
a
e
f
d
c
b
Mechacon board
Eject lever
Guide of cassette housing bracket
Rectangular cutout on the main deck

Fig. 4-13

4.5.2 Upper drum

1. Unsolder the wires leading to the lower drum from the relay pins of the upper drum. (Perform this operation swiftly to avoid damaging the wires.)
2. Remove the screws and pull the upper drum assembly off in the upward direction for replacement.
3. Use alcohol to clean the lower face of the new upper drum assembly and the upper face of the lower drum.
4. Install the new upper drum assembly by reversing the above steps. During this process, take care not to directly touch the video heads or scratch the drum.

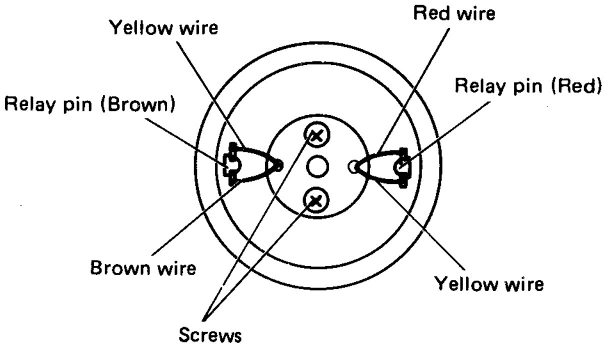

Yellow wire
Red wire
Relay pin (Red)
Relay pin (Brown)
Brown wire
Yellow wire
Screws

Fig. 4-14

4.5.3 Take-up gear assembly

1. In the ordinary condition, the lower take-up gear wheel is blocked by the take-up main brake and the rod (1), preventing the take-up gear from being removed.
2. Remove the slit washer (A) on top of the take-up pulley, and pull off the pulley in the upward direction, while paying attention to spring (B) and washer (C).

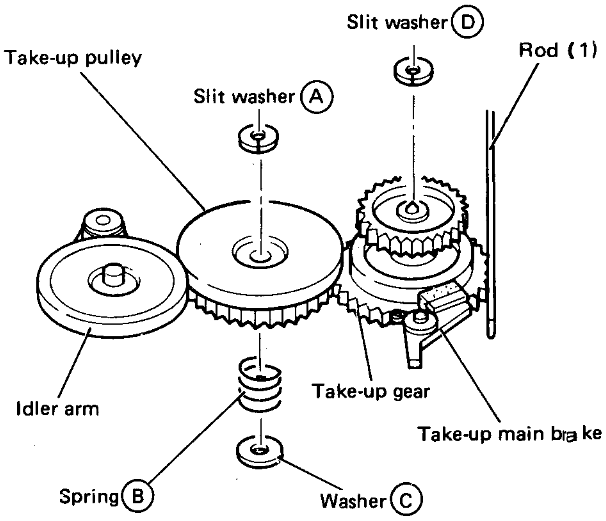

Slit washer Ⓓ
Take-up pulley
Rod (1)
Slit washer Ⓐ
Idler arm
Take-up gear
Take-up main brake
Spring Ⓑ
Washer Ⓒ

Fig. 4-15

3. Remove the slit washer (D) on top of the take-up gear, and pull off the gear in the upward direction, while pulling the take-up main brake outwards and paying attention to the rod (1).
4. Reassemble the take-up gear by reversing the above steps.

   Note: Be sure to clean the pulley before reassembling the take-up pulley and take-up gear.
5. After completing the reassembly procedure, check the take-up torque according to the following steps.
6. Insert the cassette torque meter into the cassette housing and set the unit to the playback mode.
7. Confirm that the pointer indication on the take-up side is 40 ± 15 g-cm.

4.5.4 Reel motor assembly/Idler arm

1. Remove the wires from the reel motor.
2. Remove screw (A) and remove the reel motor assembly for replacement.
3. Reassemble by reversing the above steps, while paying attention to motor wire polarity.
4. After completing the reassembly procedure, perform "Reel Motor Voltage Adjustment (Mechacon Board)" as described in the section "Electrical Adjustments".
5. For replacement of the idler arm, remove the slit washer (B) of the idler arm and pull off the arm in the upward direction.
6. Before reinstalling the idler arm, perform cleaning of the rubber section.
7. After reasssembly, use the cassette torque meter to confirm that take-up torque is 40 ± 15 g-cm.

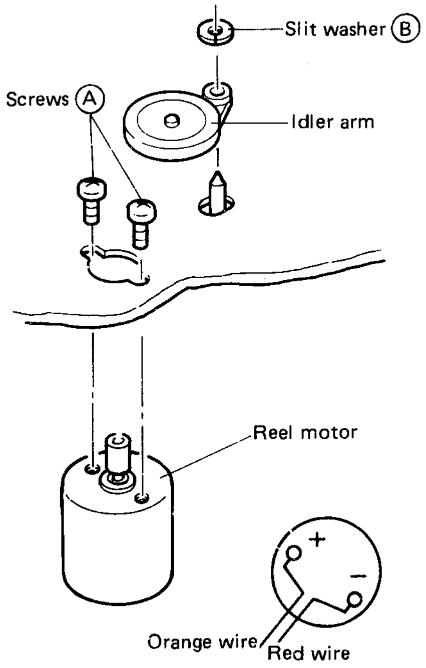


Fig. 4-16

4.5.5 Loading motor

1. Disconnect the 12-P cap housing from the junction board, while paying attention to the flexible board.
2. Turn the loading gear by hand to bring the pole base to about midway loading position.
3. Remove screws (A) and remove the loading gear assembly.
4. Remove the wires from the loading motor, and remove the loading belt.
5. Remove setscrew (B) from the motor pulley, and remove the pulley from the loading motor.
6. Remove screws (C) from the motor bracket, and remove the loading motor for replacement.
7. Reassembly of loading motor and loading gear assembly is performed by reversing the above steps. Before installing the loading gear assembly, the loading ring must be brought into the loading end position.

   Note: It is very important that the loading gear and the loading ring are properly engaged.
8. Turn the loading gear by hand and confirm that the supply and take-up pole bases reach the pole guides on top of the drum assembly at approximately the same time. If not, the loading gear assembly's mounting position must be corrected.

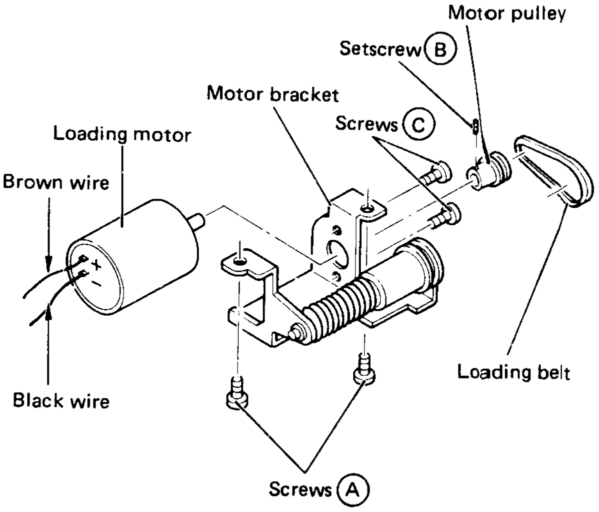


Fig. 4-17

4.5.6 Audio/control head assembly

1. Remove screws (A), (B) and (C).

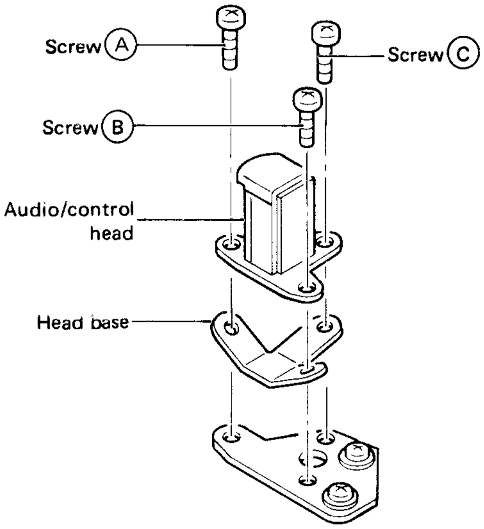


Fig. 4-18

2. Unsolder the audio/control head wires from the audio circuit board, and replace the audio/control head assembly.
3. Reattach the audio/control head assembly by reversing the above steps. Take care that the A/C head height approximately matches the tape travel path.
4. Perform tape transport adjustment according to the following steps.
   1) Insert a cassette tape (to be used for own recordings) and set the unit to the playback mode.
   2) Adjust screw (B) for smooth tape transport at the tape guide.

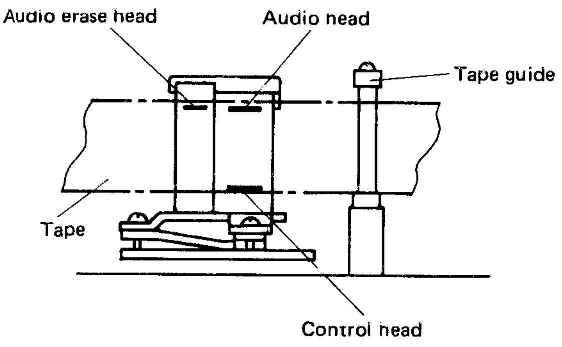


Fig. 4-19

5. Perform adjustment of A/C head height and azimuth, according to the following steps.
   1) Play back the 6-kHz audio signal of the alignment tape (stairstep signal section).
   2) Turn screws (A), (B) and (C) in succession by small and equal increments, until the audio output becomes maximum. Then use screw (A) as a reference and adjust the A/C head tilt with screw (B) and the audio azimuth with screw (C).
   3) Repeat these adjustments until the A/C head height is as shown in Fig. 4-19 and audio level fluctuations are at minimum.

Note:
- In order to perform correct adjustment and protect the alignment tape from damage, screw (A) used as reference should not be turned by more than one quarter-rotation at a time.
- After screw (B) was turned, the audio azimuth must always be adjusted with screw (C).

4.5.7 Tension arm assembly

1. Remove the slit washer on top of the supply reel disk, and remove the supply reel disk assembly by pulling it off in the upward direction.
2. Turn the loading motor by hand to bring the pole base into the loading end position.
3. Remove spring (A).
4. Remove the slit washer (B) from the tension arm, remove the tension band adjustment screw (C), and pull off the tension arm assembly in the upward direction, while paying attention to the washer, tension band and cancel lever assembly.
5. Remove the slit washer (D) below the tension arm, and replace the tension band.
6. Reattach the tension band assembly and reel disk assembly by reversing the above steps.

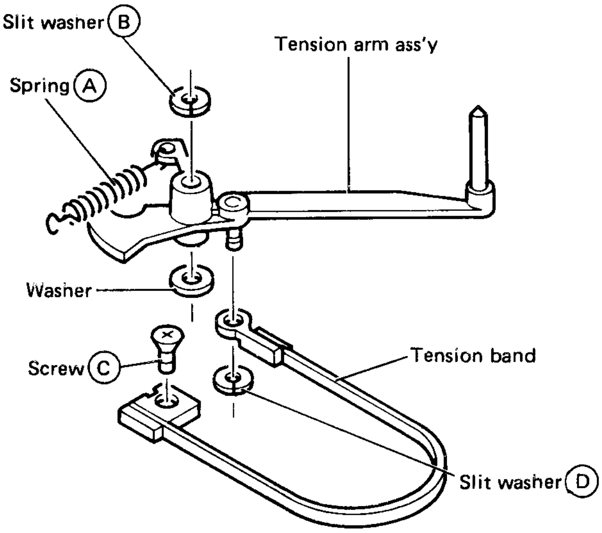


Fig. 4-20

7. After completing the reassembly procedure, perform adjustment of the tension pole position according to the following steps.
   1) Block the light from reaching the end sensor and short-circuit the cassette switch.
   2) Apply DC power to the unit, set it to the playback mode without a tape, and switch off the DC power just before the loading process is completed.
   3) Use the height gauge to check the amount of vertical tilt of the tension pole.
   4) If a large tilt is observed, correct it by using the tension arm bending tool to bend the tension arm. (Be careful not to bend the arm excessively.)

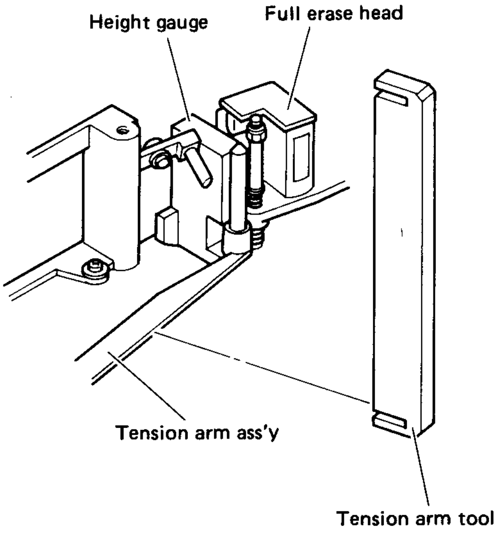


Fig. 4-21

   5) Apply DC power and set the unit to the playback mode.
   6) Check whether the tension arm is positioned in the center of the circular chassis hole.
   7) If necessary, loosen screw (C) and adjust the position of the tension band holder.

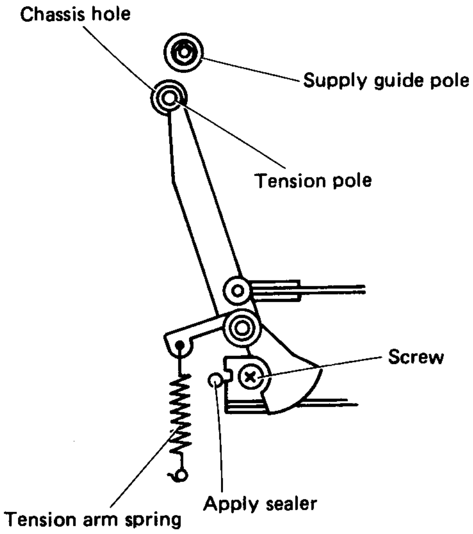


Fig. 4-22

   8) Insert the cassette torque meter and set the unit to the playback mode.
   9) Confirm that back tension on the supply side is 25 ± 5 g-cm.

   Note: The back tension is determined by the tension arm spring at the tension pole position. If necessary, first confirm that the tension pole is in the correct position, and then perform back tension check by employing the cassette torque meter in the playback mode. If largely off-standard readings are obtained, replace the tension arm spring and reconfirm the tension pole position.

4.5.8 Pinch roller

1. Remove screw (A) and remove the pinch roller assembly by pulling it off in the upward direction.
2. Replace the pinch roller assembly.

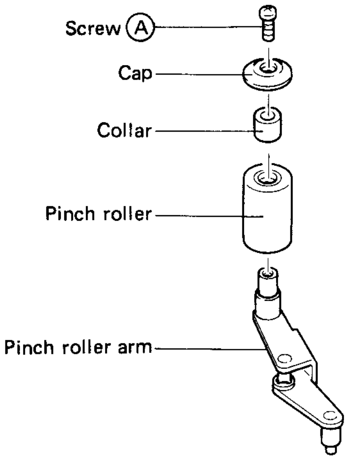


Fig. 4-23

Note: Be careful not to apply excessive force when tightening the pinch roller screw, to avoid lengthwise deformation of the pinch roller arm assembly.

3. Insert a cassette tape (to be used for own recordings) and confirm that tape travel at the beginning of the tape is stable and the tape does not touch the upper or lower guide edges.

4.5.9 Brake solenoid

1. Pull out the wire connector leading to the solenoid from the junction board.
2. Remove screws (A) and remove the record safety assembly.
3. Remove the E-ring (B) on top of the slide plate.
4. Remove screws (C) and remove the solenoid bracket.
5. Remove screws (D) and remove the solenoid for replacement.
6. Reassemble by reversing the above steps. After completing the reassembly procedure, confirm that the solenoid smoothly operates the slide plate.

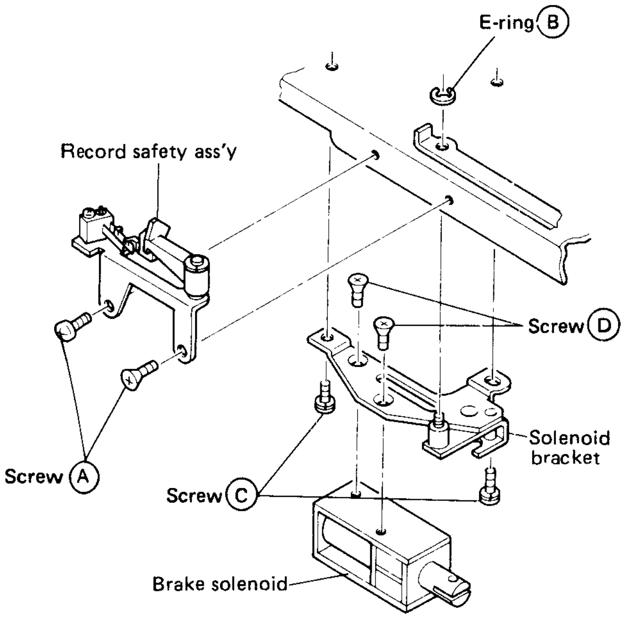


Fig. 4-24

4.6 TAPE TRANSPORT SYSTEM CHECKS AND ADJUSTMENT

The tape transport system has been precisely aligned at the factory and normally does not require readjustment. The following steps are therefore necessary only in cases of severe usage or when replacing parts affecting the tape transport system.

Note: To operate the set with the cassette housing removed, close or short the terminals of the cassette switch.

4.6.1 Tape transport check

1. Employ a cassette tape and check at tape beginning and ending portion according to the following steps.
2. Operate the machine between Play and Stop modes several times.
   During Loading and Unloading, observe the tape at the supply and take-up guide rollers and guide poles.
   Confirm absence of curling, wrinkling, etc. as shown in Fig. 4-25.

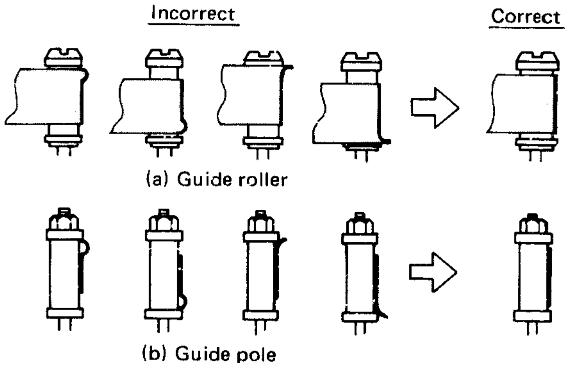


Fig. 4-25 Guide roller and guide pole

3. Observe the tape as it becomes wrapped around drum during loading and as it separates from the drum during unloading.

   Confirm absence of damage to the tape at points Ⓐ and Ⓑ as shown in Fig. 4-26 and absence of contact noise between head tips and tape edge.

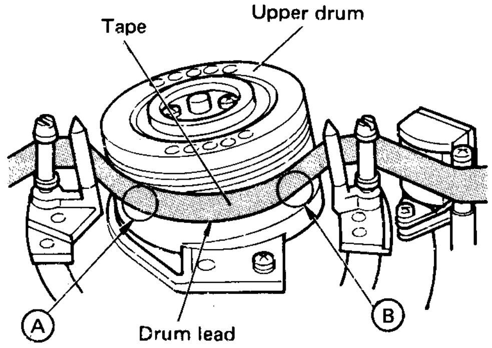


Fig. 4-26 Drum lead check

NOTES:

1. Slips upward : sound becomes produced by contact between tips of rotating heads and edge of tape.
2. Slips downward : tape curls or wrinkles from contacting lead face (sound may also be produced).

4. During Play mode, observe tape at the input and output portions (Ⓒ and Ⓓ in Fig. 4-27) of the head drum lead.
   Confirm that the tape slips neither upward nor downward with respect to the lead as shown in Fig. 4-27.

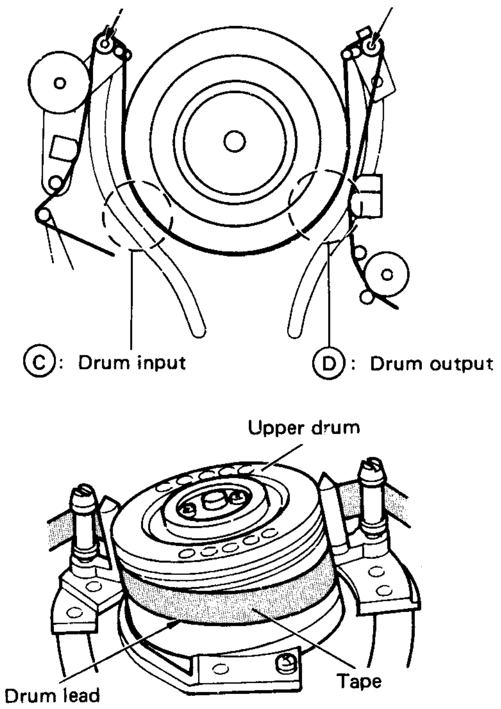


Fig. 4-27 Tape transport check

5. During Play mode, observe the tape at the take-up and supply guide poles and guide rollers.
   Confirm absence of curling, wrinkling, etc. as shown in Fig. 4-25.
6. If defects are noted the above checks, perform the following adjustments.

4.6.2 Tape transport adjustments

Perform only if defects are noted during tape transport check (4.6.1).

A: Guide roller height adjustment

1. Slightly loosen setscrews of the supply and take-up guide rollers as shown in Fig. 4-28.
2. Use a cassette tape and set for Play mode.
3. With a slotted screwdriver, slightly turn the supply guide roller (do not turn more than 180° at a time) and adjust so that at the drum input, the tape travels smoothly in the drum lead without slipping upwards or downwards.
4. Similarly, adjust the take-up guide roller for the drum output.

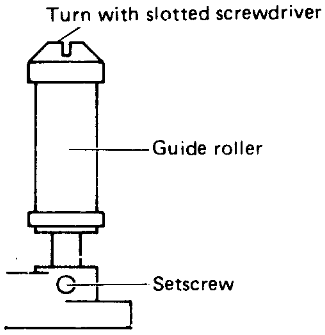


Fig. 4-28 Guide roller height adjustment

NOTES:

1. Loosen the setscrews only enough to allow the guide rollers to be turned.
   If excessively loose, tape motion may turn the rollers inadvertently.
2. Turn the rollers carefully to avoid damage to the tape.

B: Supply guide pole height adjustment

(a) Height check

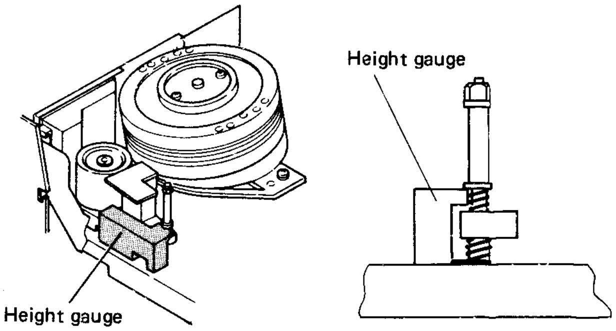


Fig. 4-29 Guide pole height check

1. Set the height gauge on the deck as shown in Fig. 4-29.
2. For guide pole, check the height of the lower face of the lower flange. If necessary, carefully adjust by turning the nut.
3. If guide pole height has been adjusted, follwing adjustments are required.

(b) Height adjustment

1. Use a cassette tape and set for Play mode.
2. Use a metric nutdriver to turn the supply guide pole to align the lower flange of the guide pole with the lower edge of the tape as shown by (b) of Fig. 4-25. Howerver, this adjustment must be performed so that at the same time, the lower flange remains within ±0.5 mm of the height adjusting jig portion shown in Fig. 4-29.

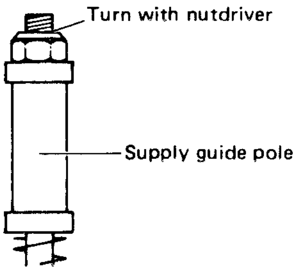


Fig. 4-30 supply guide pole height adjustment

3. If there is a large descrrepancy, check the tension pole and other mechanical components.

C: Audio/control head adjustment

1. Employ a cassette tape and set for Play mode.
2. Adjust audio/control head screw Ⓑ to align the lower edge of the tape with the lower flange of the tape guide for smooth transport.

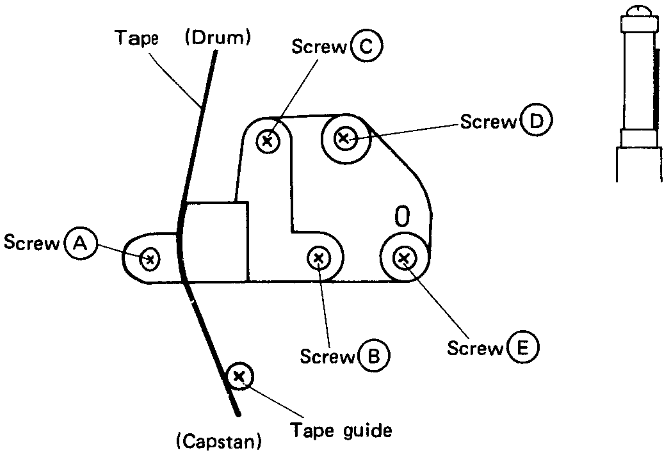


Fig. 4-31 A/C head

4.7 INTERCHANGEABILITY ADJUSTMENT

Before using alignment tape, employ a tape and confirm correct tape transport.

4.7.1 Preliminary checks

A: Check sequence 1

1. Connect oscilloscope to TP-6 of Y/C board.
   At this time, trigger the oscilloscope externally with the signal (25 Hz square wave) from TP-11 (DRUM F.F.) of Y/C board.
2. Play Stairstep portion of the alignment tape MH-C2.
3. Turn the Tracking control and adjust for maximum FM output at TP-6.
   Set the Tracking control to AUTO (center click position) and confirm that nearly maximum output is obtained.

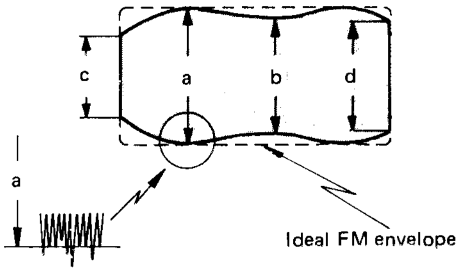


Fig. 4-32 FM waveform (max. output)

4. Refer to Fig. 4-32. Read the level of portion (a) of the waveform. If the waveform is serrated at point (a), read the value at the most uniform serrations as shown at left in Fig. 4-32.
5. Read the maximum FM level (a) and minimum FM level (b), and confirm that:

$$\frac{b}{a} \geqq 0.7 \text{ or } 20\log\frac{b}{a} \geqq -3\text{ dB}$$

6. Read the values at points (c) and (d) [drum input and output] and confirm that:

$$\frac{c}{a} \geqq 0.5 \text{ and } \frac{d}{a} \geqq 0.5 \ (\geqq -6\text{ dB})$$

7. Supply a video signal, record and then playback.
8. Confirm steps 5 and 6.

NOTES:
1. Read minimum levels for (b), (c) and (d).
2. If above checks yield normal results, proceed to section 4.7.1 -B.
3. If defects are noted, perform adjustments of section 4.7.2.

B: Check sequence 2

1. Observe the FM waveform as in the previous section (4.7.1 -A) and turn the Tracking control.
   The waveform variation should be nearly parallel as shown in Fig. 4-33.

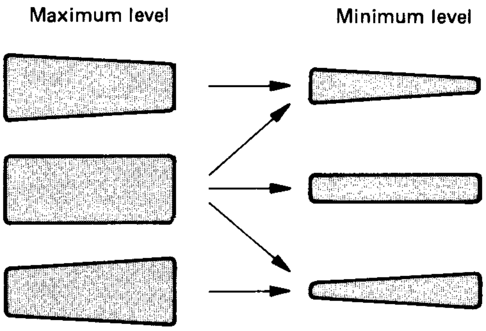


Fig. 4-33 Normal waveform examples

2. If the waveform varies as shown in Fig. 4-34, adjustment becomes required.

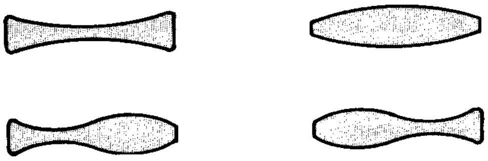


Fig. 4-34 Incorrect waveform examples

4.7.2 Preliminary adjustments

1. Loosen the setscrews of the supply guide roller and take-up guide roller.
   If the guide rollers turn freely, slightly tighten the setscrews.
2. Connect oscilloscope to TP-6 of Y/C board.
   Trigger the oscilloscope externally with the signal from TP-11 (DRUM F.F.) of Y/C board.
3. Play the alignment tape (stairstep signal) MH-C2.

A: Drum input

1. Observe oscilloscope display and adjust the Tracking control for maximum FM output.
2. Refer to Fig. 4-35. Examples of incorrect waveforms are shown by A.
   Use a slotted screwdriver to adjust the supply guide roller so that the rising portion (drum input portion) of the waveform becomes flat as shown by B.

   NOTES:
   1. If the guide roller turns freely, tighten the setscrew slightly.
   2. Be sure to adjust the guide roller only by small amounts at a time in order to avoid damaging the alignment tape.

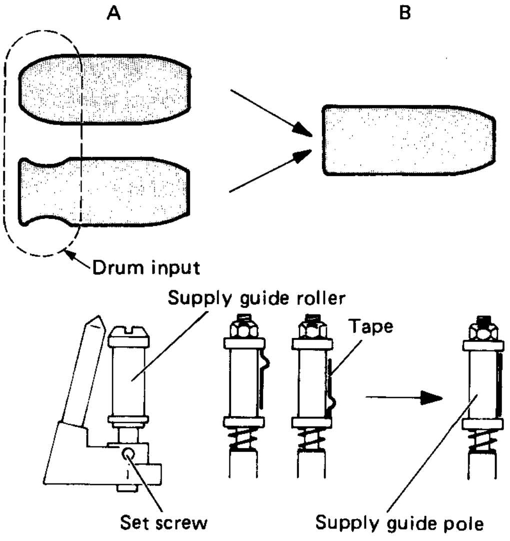


Fig. 4-35 Drum input adjustment

   In addition to observing the waveform, confirm absence of tape slippage or curling at the drum lead and guide poles.
3. At the supply guide pole, if the tape separates from the guide or wrinkling occurs, adjust the guide pole height. (See section 4.6.2, B.)

B: Drum output

1. In the same manner as for the drum input, turn the take-up guide roller to adjust the falling portion (drum output portion) of the FM waveform.
   Incorrect examples are shown by C in Fig. 4-36, while D indicates the correct adjustment.
2. Employ a blank tape, record and then playback confirm steps 5 and 6 of section 4.7.1, A.
3. If necessary, fine adjust by turning the take-up guide roller very slightly clockwise. Again confirm according to check sequence of section 4.7.1, A.

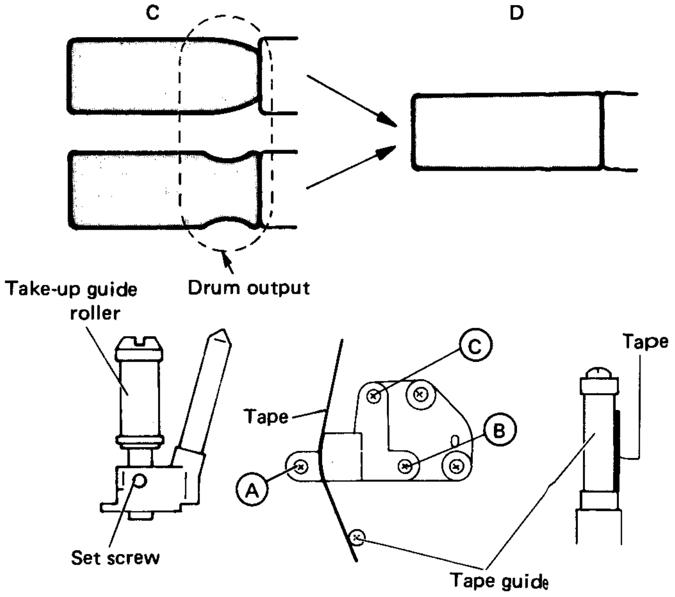


Fig. 4-36 Drum output adjustment

4 If the tape separates from the tape guide or wrinkling occurs, adjust by turning screw Ⓑ of the audio/control head to align the lower edge of the tape with the lower flange of the tape guide for smooth transport.

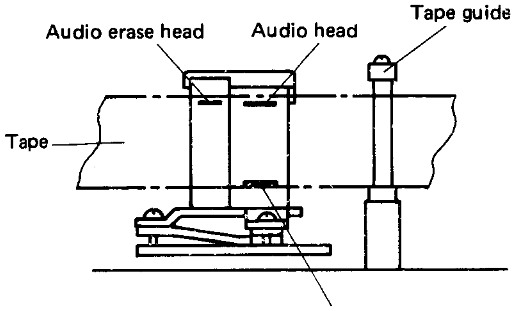


Fig. 4-37 Audio/control head height

5. Carefully and evenly adjust screws Ⓐ, Ⓑ and Ⓒ to align the audio/control head height with the tape as shown in Fig. 4-36.

NOTES:

1. Fine adjustment is not required at this time.
   It is sufficient that the tape is engaged with the guide pole and servo operates stably (control signal picked up).
2. If the tape separates from the tape guide or wrinkling occurs, screw Ⓑ (Fig. 4-36) has been turned excessively with respect to screws Ⓐ and Ⓒ, causing the audio/control head to incline forward or rearward. Use care to adjust screws Ⓐ, Ⓑ and Ⓒ evenly and observe that small wrinkles are not produced at the tape guide.

4.7.3 Interchangeability fine adjustment

1. Connect oscilloscope to TP-6 of Y/C board.
   Play stairstep segment of the alignment tape MH-C2. Observe the FM waveform and adjust the Tracking control for minimum FM output level.

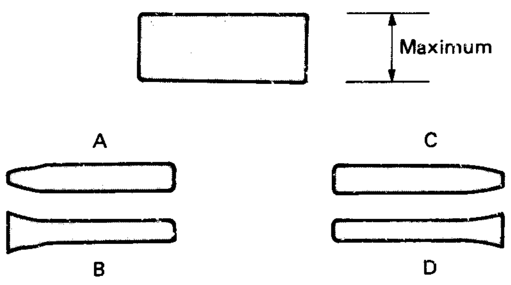


Fig. 4-38 Minimum FM output (incorrect examples)

2. If the waveform becomes as shown by A or B of Fig. 4-38, carefully adjust the supply guide roller height so that the waveform becomes as shown by E, F or G of Fig. 4-39.
   At this time, if the waveform fluctuates, adjust to the point of minimum fluctuation.

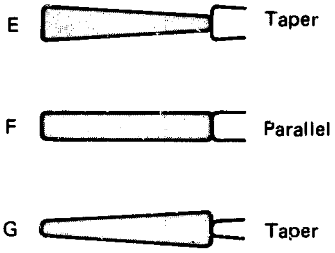


Fig. 4-39 Minimum FM output (correct examples)

3. If the FM waveform appears as shown by C or D in Fig. 4-38, carefully adjust the take-up guide roller height to obtain a waveform such as shown by E, F or G of Fig. 4-39.
   At this time, if the waveform fluctuates, adjust to the point minimum fluctuation.
4. Vary the Tracking control from maximum to minimum FM output.
   Perform fine adjustment of supply and take-up guide rollers so that waveform variation becomes as shown by E, F or G of Fig. 4-39.

4.7.4 Audio/Control head height, azimuth and inclination

See section 4.5.6 Audio/control head assembly.

4.7.5 Setscrew tightening

1. Check for maximum FM output waveform, maximum audio out and absence of tape wrinkling or other transport irregularities, then secure the guide rollers.
   Perform in Stop mode.
2. Since the guide rollers are easily moved, use care when securing.
3. After tightening the setscrews, again perform interchangeability final check.

4.7.6 Interchangeability final check

Confirm section 4.7.1 Preliminary checks.

4.7.7 Servo circuit adjustment (See section 5.4)

1. Video head switching position.
2. Tracking preset.

4.7.8 Control head phase adjustment

1. Connect oscilloscope to TP-6 of Y/C board.
   Trigger the oscilloscope externally with the signal from TP-11 (Drum F.F.) of Y/C board.
2. Play stairstep portion of the alignment tape MH-C2 and observe the oscilloscope display.
3. Set the Tracking control to AUTO (center click position).
4. Confirm that the level difference between this setting and the maximum level obtained manually is:

$$-20 \log \frac{b}{a} \leqq 1\ \text{dB} \ \text{or} \ \frac{b}{a} \geqq 0.9$$

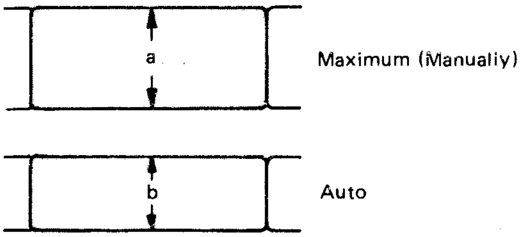


Fig. 4-40 FM output level

5. If necessary, adjust as follows.
6. Set the Tracking control to AUTO and play stairstep segment of the alignment tape MH-C2.
7. Loosen two screws Ⓓ and Ⓔ and slide the A/C head assembly fully in the direction of the capstan.

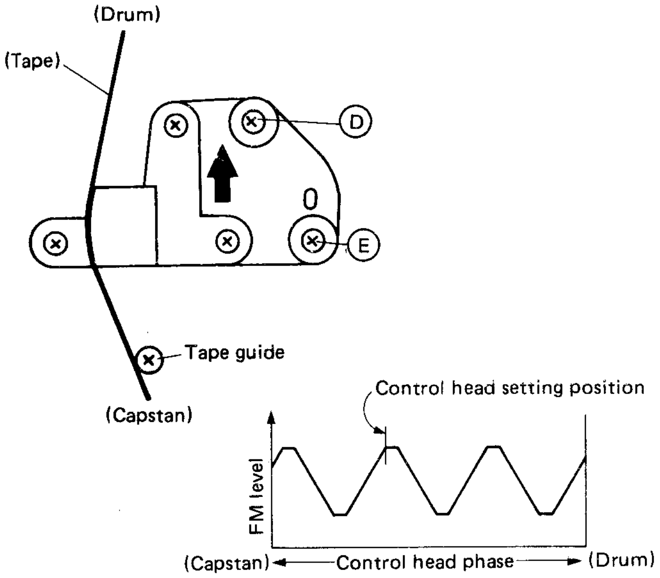


Fig. 4-41 Control head phase adjustment

8. Slightly tighten the two screws and play stairstep segment of the alignment tape MH-C2.
9. Set the audio/control head position tool (PUJ47351-2) over the screw Ⓔ and insert the pin of the tool into the hole at the side of the screw.
10. Slowly turn the tool and slide the A/C head assembly in the direction of the arrow as shown in Fig. 4-41.
11. Set the A/C head assembly to the position where second maximum FM level is obtained. Tighten two screws Ⓓ and Ⓔ.

4.7.9 Final checks (recording and playback)

1. Use a blank tape and perform recording and playback.
   Confirm FM waveform and specifications equivalent to those during playback of alignment tape (stairstep signal). See section 4.7.1.
2. Perform checks and adjustments of the audio recording and playback levels. See section 5.6 Audio circuit.
3. Check other signal systems by referring to section 5 electrical adjustment.

SECTION 5
ELECTRICAL ADJUSTMENTS

5.1 PREPARATION

Electrical adjustments are required after replacing circuit components and certain mechanical parts. It is important to perform these adjustments only after all repairs and replacements have been completed. Also, do not attempt these adjustments unless the proper equipment is available.

5.1.1 Required test equipment and jig

1. Color TV monitor
2. Oscilloscope: Wide band
3. Signal generator: Color bar, Stair-step
4. Frequency counter
5. Regulated DC power supply (5 A)
6. Audio generator
7. Alignment tape (MH-C2)
8. Digital voltmeter

5.1.2 JVC alignment tape contents

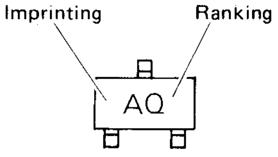
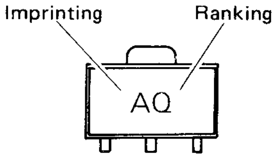
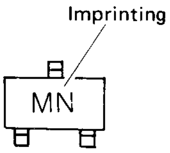
Segment	Playback Time	Video Signal	Audio Signal	Applications
1	3 minutes	(none)	(none)	
2	5 minutes	Stairstep	6 kHz	● Interchangeability checks and adjustments ● Servo circuit checks and adjustments ● Audio head azimuth adjustments
3	3 minutes	(none)	3 kHz	● Tape speed checks ● Wow and flutter checks
4	6 minutes	Color bar	1 kHz	● Video signal playback circuit checks and adjustments ● Audio signal playback circuit checks and adjustments
5	2 minutes	RF sweep	(none)	● Video head resonance adjustments Marker: 2 MHz, 4 MHz, 5 MHz

Table 5-1 MH-C2 contents

5.1.3 Replacing subminiature "Chip" parts

Additional compactness is achieved by using subminiature chip parts for certain circuit elements. When replacing these parts, note the cautions outlined below.

Chip transistors and diodes used in this model are outlined as follows.

Transistors				Diodes	
Type	Imprinting	Type	Imprinting	Type	Imprinting
2SB709	A	2SB798	O	MA151WA	MN
2SB710	C	2SD999	C	MA151WK	MT
2SC2716	F	2SD1119	T		
2SC2757	T32				
2SD601	Y				
2SD602	W				
 (Standard type)		 (Power type)			

1. Required tools:
   1) Fine tipped, well insulated soldering "pencil", about 15 Watts.
   2) Tweezers
   3) Blower type hair dryer.
2. Soldering cautions:
   1) Do not apply heat for more than 3 seconds.
   2) Avoid using a rubbing stroke when soldering.
   3) Discard removed chips; do not reuse them.
   4) Supplementary cementing is not required.
   5) Use care not to scratch or otherwise damage the chips.
3. Removal (resistors, capacitors, etc.):
   1) Melt the solder at one side.

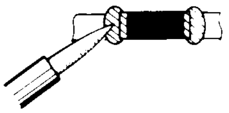


Fig. 5-1

   2) Grasp the part with tweezers and melt the solder at the other side.

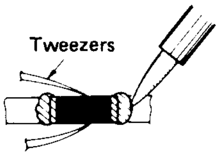


Fig. 5-2

   3) Remove the part with a twisting motion.

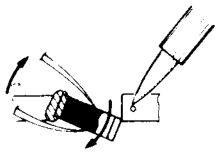


Fig. 5-3

4. Removal (transistors, diodes, etc.):
   1) Melt the solder of one lead.

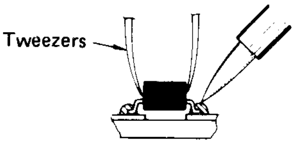


Fig. 5-4

   2) Lift the side of that lead upward.

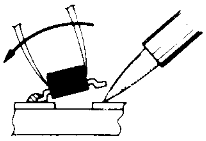


Fig. 5-5

3) Simultaneously heat the solder of the two remaining leads and lift part to remove.

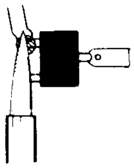


Fig. 5-6

5. Preheating (except for semiconductors):

   Immediately before installing new resistors or capacitors, use a blower type hair dryer and preheat the part for about two minutes at approximately 150°C.

6. Replacement:

   1) Presolder the contact points of the circuit pattern.

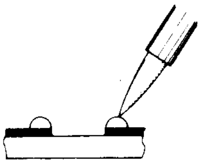


Fig. 5-7

2) Press the part downward with tweezers and apply the soldering pencil as indicated in the figure.

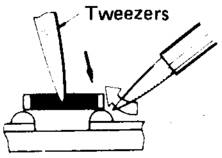


Fig. 5-8

5.1.4 Check and Adjustment steps

The check and adjustment steps are provided in the following in the form of charts. For clarity, the nomenclature used in the charts is outlined below.

No.	Checks and adjustments are numbered in the recommended sequence in which they are to be performed.
Item	Name assigned to the particular check and adjustment step.
Check Point	Location to which measuring instrument (oscilloscope unless otherwise noted) is to be connected.
Adjustment Parts	Variable component (resistor, capacitor, etc.) to be adjusted in this step. Dash (–) indicates check only.
Signal & Mode	● Input signal required to perform adjustment. Dash (–) indicates that special signal is not required. ● Equipment operating mode at time of check or adjustment.
Color bar	Color bar signal as video input
Stairstep	Stairstep signal as video input
1 kHz	Supply a 1 kHz sinewave as audio input signal.
MH-C2 Color bar	Play color bar segment of JVC MH-C2 alignment tape.
MH-C2 Stairstep	Play stairstep segment of JVC MH-C2 alignment tape.
MH-C2 1 kHz	Play 1 kHz audio signal segment of JVC MH-C2 alignment tape.
MH-C2 RF sweep	Play RF sweep segment of JVC MH-C2 alignment tape.
STOP	Power on and machine in Stop mode
REC	Recording mode
P.B.	Play mode
REC → (another mode)	Use blank tape, record, then play back in the mode specified.
SEARCH	Shuttle Search (S-FWD and S-REV) playback mode
Description and Waveform	This column provides an explanation of the step, notes, adjustment values and waveform diagrams.

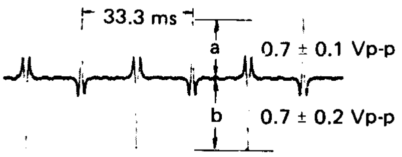
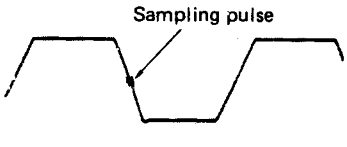
5.2 SWITCHING REGULATOR CIRCUIT

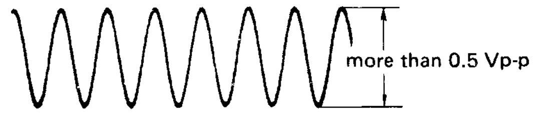
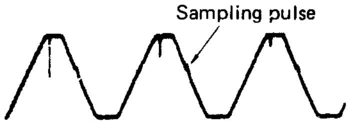
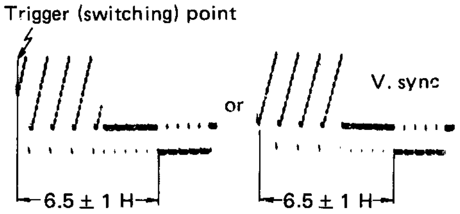
No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
1	5 V DC Output Voltage	CN1 Pin 8 SW REG	VR2	STOP	1. Connect the digital voltmeter to CN1 pin 8 of the switching regulator board. 2. Adjust VR1 for 5 ± 0.1 V DC.
2	9 V DC Output Voltage	CN1 Pin 2 SW REG	VR1	STOP	1. Connect the digital voltmeter to CN1 pin 2 of the switching regulator board. 2. Adjust VR1 for 9.0 ± 0.15 V DC.

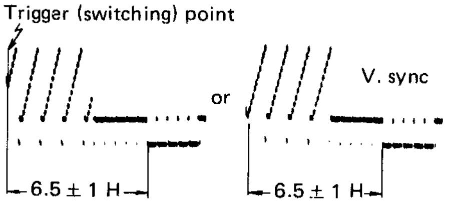
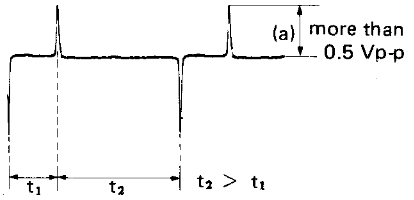
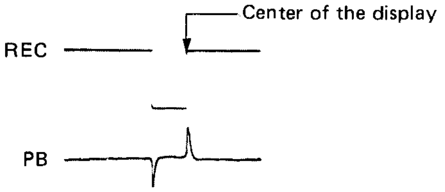
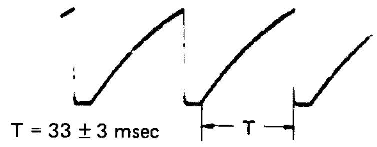
5.3 MECHACON CIRCUIT

No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
1	Battery Alarm	Battery LED	R24 Mechacon	STOP	1. Set the voltage of DC power supply for 11.0 V. 2. Adjust R24 to the point that Battery Alarm LED starts to light.
2	Battery Down Stop	Power LED	R32 Mechacon	STOP	1. Set the voltage of DC power supply for 10.3 V. 2. Adjust R32 to the point that the power turns off.
3	Reel Motor Voltage	TP-301 TP-8 Servo & MDA	–	P.B.	1. Connect the digital voltmeter between TP-301 and TP-8 (GND) of the Servo & MDA board. 2. Confirm that the voltage of TP301 is 2.8 ± 0.2 V DC.
4	Operation Check				Refer to Sec. 3.1.5 and 3.1.6.

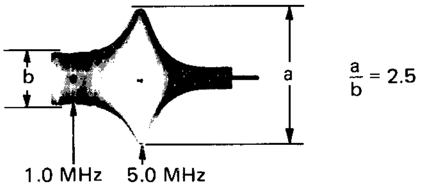
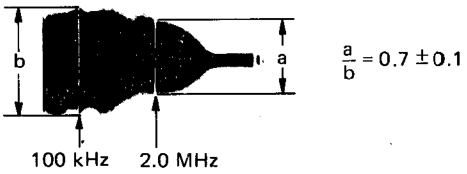
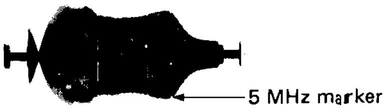
5.4 SERVO CIRCUIT

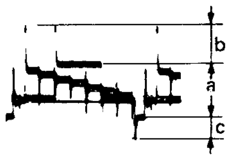
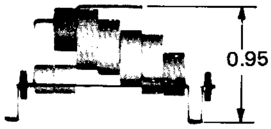
No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
1	Drum Pulse Level	TP-10 Servo	R74 Servo	Color bar or TV signal REC	1. Connect oscilloscope to TP-10 of the Servo board. 2. Adjust R74 so that the positive level (a) becomes 0.7 ± 0.1 Vp-p. 3. Confirm that the negative level is 0.7 ± 0.2 Vp-p.  Note: Drum Servo must be locked.
2	Drum Sampling Position	TP-5, TP-7 Servo	R206 Servo	Color bar or TV signal REC	1. Connect oscilloscope to TP-5 of the Servo board. Trigger the oscilloscope externally (+ slope) with the signal from TP-3 of the Servo board. 2. Adjust R206 to where the sampling pulse is positioned at the center of the trapezoid. 3. Connect the digital voltmeter to TP-7 and re-adjust R206 to obtain 2.5 V DC (±0.1 V DC). 

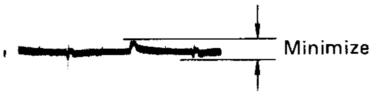
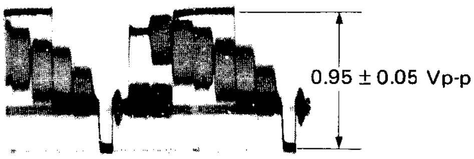
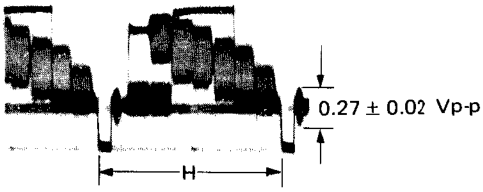
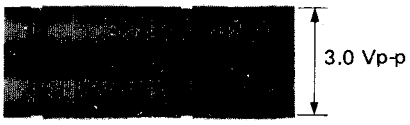
No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
3	Capstan FG Level	TP-1 Servo	–	Color bar or TV signal REC	1. Connect oscilloscope to TP-1 of the Servo board. 2. Confirm that the voltage of TP-1 is more than 0.5 Vp-p and the frequency is 252 Hz. 3. Confirm that the capstan FG level fluctuation between a and b becomes less than 1.41.  b (Max. level)/a (Min. level) ≦ 1.41
4	Capstan Sampling Position	TP-6 TP-12 Servo	R2 Servo	Color bar or TV signal REC	1. Connect oscilloscope to TP-6 of the Servo board. 2. Trigger the oscilloscope externally (+ slope) with the signal from TP-3 of the Servo board. 3. Adjust R2 to where the sampling pulse is positioned at the center of the trapezoid. 4. Connect the digital voltmeter to TP-12 and re-adjust R2 to obtain 2.5 V DC (± 0.1 V DC). 
5	P.B. Switching Point	VIDEO OUT or TP-10 Y/C	R18(CH-1) Servo R20(CH-2) Servo	MH-C2 Stairstep P.B. (+) Trigger (–) Trigger	1. Connect oscilloscope to video out or TP-10 of the Y/C board. 2. Trigger the oscilloscope externally (+ slope) with the signal from TP-3 of the Servo board. 3. Adjust R18 to the position that the trigger point is 6.5 ± 0.5 H from V. sync. 4. Trigger the oscilloscope externally (– slope) with the signal from TP-3 of the Servo board. 5. Adjust R20 to the position that the trigger point is 6.5 ± 0.5 H from V. sync.  Trigger (switching) point V. sync or 6.5 ± 1 H 6.5 ± 1 H

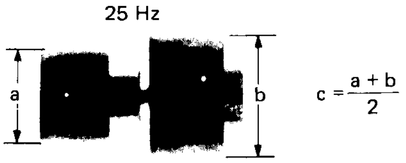
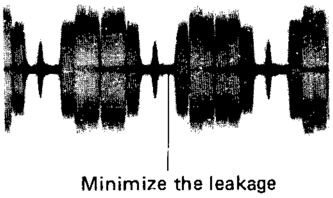
No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
6	Rec. Switching Point	VIDEO OUT or TP-10 Y/C	R27 Servo	Color bar REC (+) Trigger	1. Supply a color bar signal to video in. Trigger the oscilloscope externally (+ slope) with the signal from TP-3 of the Servo board. 2. Connect oscilloscope to TP-10 of the Y/C board. 3. Adjust R27 to the position that the trigger point is 6.5 ± 0.5H from V. sync.  Trigger (switching) point or V. sync 6.5 ± 1 H 6.5 ± 1 H
7	P.B. CTL Pulse	TP-2 Servo	–	MH-C2 Stairstep P.B.	1. Check that level (a) is more than 0.4 Vp-p. 2. Confirm that T2 is greater than T1. 
8	Tracking Center	TP-2 TP-3 Servo	R36 Servo	Color bar REC ↓ P.B. Set tracking control to the center click position.	1. Trigger the oscilloscope externally with the signal from TP-3 of the Servo board. 2. Connect the oscilloscope to TP-2 of the Servo board. 3. Record a color bar signal, and adjust the oscilloscope to position the rising portion at the center of the display. 4. Play back the recorded portion and adjust R36 so that the positive going pulse comes to the center of the display. 
9	CTL DUTY MM	TP-11 Servo	–	MH-C2 Stairstep Search F.F.	1. Connect the oscilloscope to TP-11 of the Servo board. 2. In the search FF mode, confirm the pulse width is 33 ± 3 msec as shown in the figure. 
10	Search Speed	TV Screen	R50 Servo	MH-C2 Stairstep Search F.F. Tracking VR center	In search FF mode, adjust R50 to position the noise bars at the lower 1/6th of the picture.

5.5 VIDEO CIRCUIT

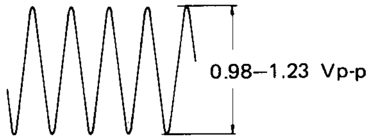
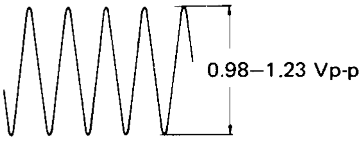
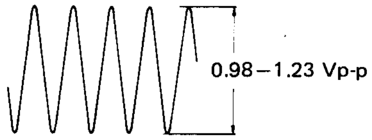
No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
1	Video Head Resonance, Q (Quality factor) and FM Equalizer	Note: This adjustment is generally unnecessary except when replacing the upper drum assembly.			1. Apply the sweep signal from a video sweep generator to TP-4 of the Y/C board. Insert 1.0 MHz and 5 MHz markers. 2. Without inserting tape, set for Play mode. Then adjust the sweep gain so that the waveform does not distort at TP-6.
	A. Factory service	TP-4 TP-6 Y/C	CH-1 R9, C7 PRE CH-2 R8, C8 PRE	Video sweep P.B.	3. At TP-6, adjust C7 for maximum level at the 5.0 MHz marker portion. 4. Adjust R9 so that the 5 MHz level becomes 2.5 times of the 1.0 MHz. 5. In the same manner, adjust C8 and R8 for CH-2.  6. Set the rear panel MODE SELECT switch to B/W. Supply a video sweep signal with the sync signal, record then play back. Insert 100 kHz and 2 MHz markers.
		TP-10 Y/C	R9 or R8 PRE R46 Y/C	Video sweep REC ↓ P.B.	7. At TP-10, measure each 2 MHz level for CH-1 and CH-2 outputs. Adjust Q control (R9 or R8) of the lower level channel for equal level at both channels. 8. Adjust R46 so that the 2 MHz level becomes 70% of the 100 kHz. 
	B. Non-factory service	TP-6 Y/C	CH-1 R9, C7 PRE CH-2 R8, C8 PRE	MH-C2 RF sweep P.B.	Note: The MH-C2 marker appears at 2 MHz, 4 MHz and 5 MHz. 1. Trigger the oscilloscope externally with the signal from TP-11 of the Y/C board. 2. Play alignment tape (RF sweep signal). 3. Use (–) trigger for CH-1 and (+) for CH-2. 4. Turn R9 and R8 in order to boost the highband frequency at TP-6. 5. Adjust C7 to set the CH-1 resonance point to the 5 MHz marker position. Similarly, adjust C8 for CH-2. 6. R9 turns 360°. Turn it counterclockwise to where the level starts to dip, then turn it an additional 45°. 7. Adjust R8 to match the CH-2 level to CH-1. 
		TV Screen	R46 Y/C	TV signal REC ↓ P.B.	8. Record an off-the-air signal, then playback. While observing the picture, adjust R46 for optimum clarity. (This adjusts the sharpness and softness of the playback picture.)

No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
2	4.43 MHz	TP-36 Y/C	R87 Y/C	MH-C2 Color bar P.B.	1. Connect a frequency counter to TP-36 of the Y/C board. 2. Adjust R87 to obtain 4433619 ± 50 Hz.
3	AFC 626 kHz	TP-33 Y/C	R88 Y/C	Color bar or TV signal REC	1. Supply a color input. 2. Connect a 680 Ω resistor between TP-41 and TP-42 of the Y/C board. 3. Connect a frequency counter to TP-33 of the Y/C board. 4. Adjust R88 to obtain 626 ± 4 kHz.
4	Carrier and Deviation (These adjustments are generally unnecessary except when replacing IC2 or IC6.)	TP-4 IC2, Pin 13 Y/C	R7 (Carrier) Y/C R37 (Deviation) Y/C	Color bar REC	1. Supply a color bar input signal. 2. Connect oscilloscope to IC2 pin 13 and precisely measure the DC potential of the sync tip. Make a note of this as voltage "A". 3. Connect a DC power supply between IC2 pin 13 and ground. 4. Without an input signal, set for the Record mode and presicely apply sync tip bias "A" as observed with the oscilloscope. 5. Connect a frequency counter to TP-4 of the Y/C board. 6. Adjust R7 to obtain 3.8 ± 0.05 MHz. 7. Carefully adjust the DC power supply to obtain 4.8 MHz ± 50 kHz at TP-4. 8. Precisely read the voltage of IC2 pin 13 with the oscilloscope. Make a note of this as voltage "B". 9. Disconnect the DC power supply. 10. Supply a color input signal. 11. Adjust R37 so that the Peak White at IC2 pin 13 becomes equal to voltage "B".
5	White and Dark Clip	TP-2 Y/C	R6 (White Clip) Y/C R4 (Dark Clip)	Color bar REC	1. Supply a color bar input signal. 2. Connect an oscilloscope to TP-2 of the Y/C board. 3. As shown in the figure, adjust R6 (White Clip) and R4 (Dark Clip).  White clip a : b = 1 : 0.8 ± 0.02 Dark clip a : c = 1 : 0.4 $^{+0.05}_{-0}$
6	E-E Y Level	VIDEO OUT	R32 Y/C	Color bar REC	1. Supply a color bar input signal. 2. With load at 75 Ω, connect an oscilloscope to VIDEO OUT. 3. Adjust R32 of the Y/C board for 0.95 ± 0.05 Vp-p.  0.95 ± 0.05 Vp-p

No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
7	Noise Cancel	TP-21 Y/C	R29 Y/C	MH-C2 Color bar P.B.	1. Play alignment tape color bar signal. 2. Adjust R29 to minimize the output level at TP-21. 
8	P.B. Y Level	VIDEO OUT	R25 Y/C	MH-C2 Color bar P.B.	1. When load at 75 Ω and connect an oscilloscope to VIDEO OUT. 2. Play JVC alignment tape (MH-C2) color bar signal. 3. Adjust R25 of the Y/C board for 0.95 ± 0.05 Vp-p. 
9	P.B. Burst Level	VIDEO OUT	R3 2H DL	MH-C2 Color bar P.B.	1. With load at 75 Ω and connect an oscilloscope to VIDEO OUT. 2. Play JVC alignment tape (MH-C2) color bar signal. 3. Adjust R3 of the 2H Delay board for a burst level of 0.27 ± 0.02 Vp-p. 
10	REC FM Level	TP-4 Y/C	R13 Y/C	Color bar REC	1. Supply a color bar input signal. 2. Connect an oscilloscope to TP-4 of the Y/C board. 3. Adjust R13(REC FM Level)so that the pedestal level of the vertical blanking component becomes 3.0 Vp-p. 

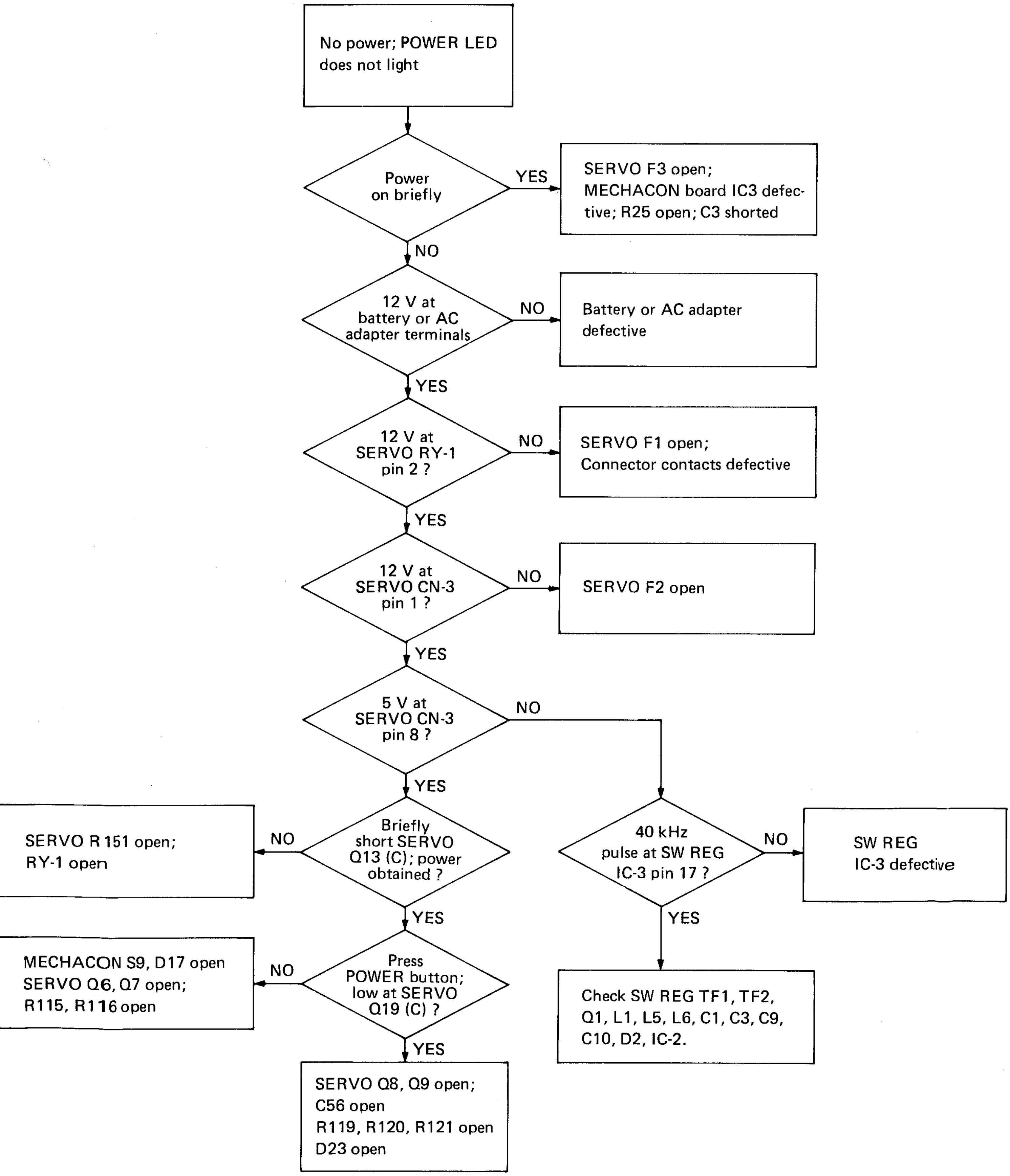
No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
11	REC Color Level	TP-34 Y/C	R90 Y/C	MH-C2 color bar Color bar REC ↓ P.B.	1. Play JVC alignment tape (MH-C2) color bar, then measure the average of CH-1 output (a) and CH-2 output (b). Make a note of this as level "c". 2. Supply color bar input signal, record then play back. 3. During recording, adjust R90 so that the average of CH-1 output and CH-2 output becomes 110% of "c", i.e., adjust during recording and check during playback. 
12	Converter Balance	TP-43 Y/C	R57 Y/C	Color bar REC ↓ P.B.	1. Supply a color bar signal, record and then play back. 2. Connect an oscilloscope to TP-43 of the Y/C board. 3. Trigger the oscilloscope externally with the signal from TP-11 of the Y/C board. 4. Adjust R57 of the Y/C board for minimum leakage of the 5.06 MHz component. 

5.6 AUDIO CIRCUIT

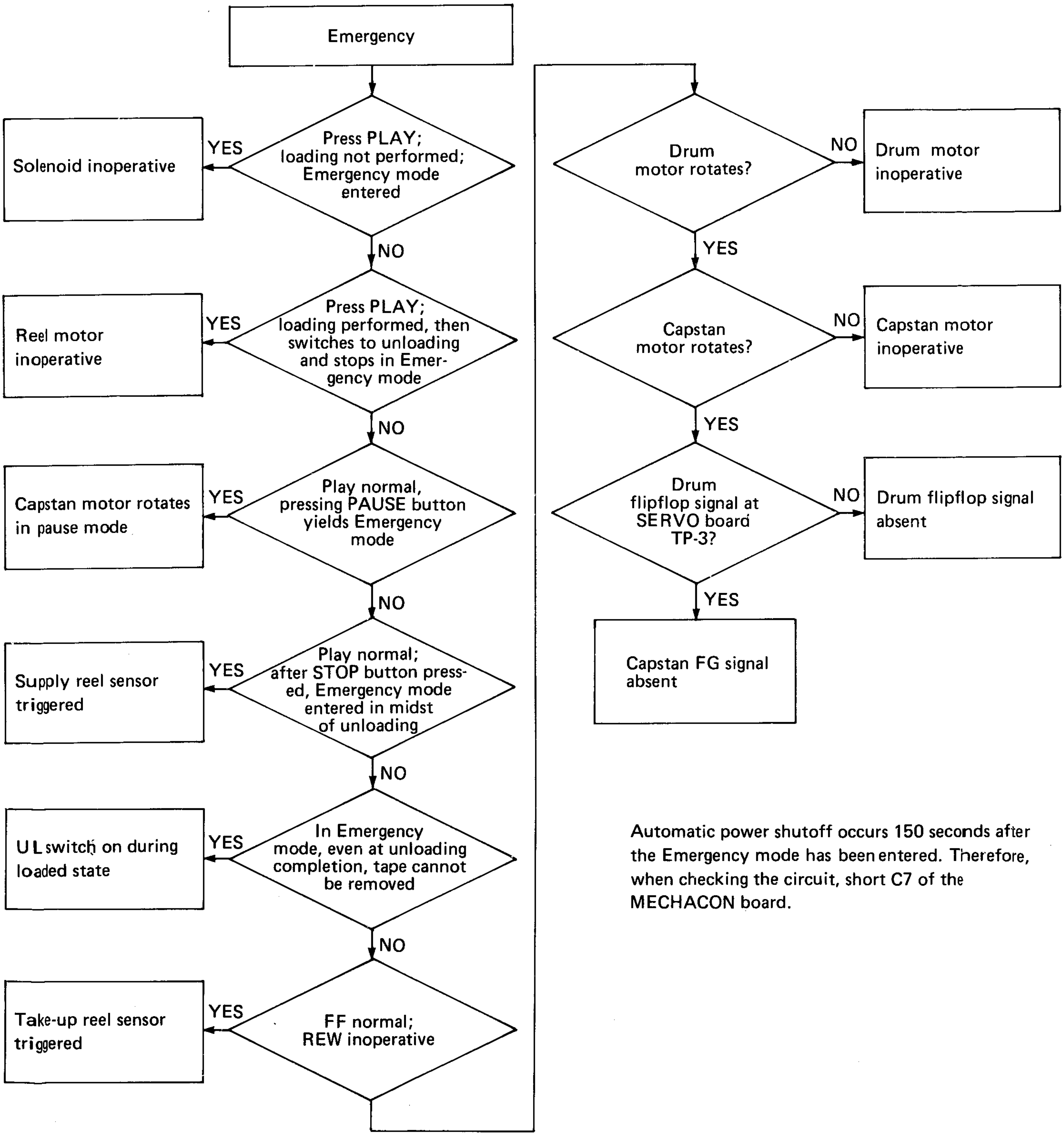
No.	Item	Check Point	Adjustment Parts	Signal & Mode	Description and Waveform
1	P.B. Level	Audio Line Out	R15 AUDIO	MH-C2 1 kHz P.B.	1. Adjust R15 for –6 ± 1 dBs (0.98–1.23 Vp-p) at audio output. 
2	E-E Level	Audio Line Out	R1 AUDIO	1 kHz –20 dB REC	1. Supply a 1 kHz –20 dB audio input signal to Camera Audio In. 2. Adjust R1 for –6 ± 1 dBs (0.98–1.23 Vp-p) at audio output. 
3	Audio Bias Level	TP-16 TP-13 Audio	R21 AUDIO	REC	1. Connect a digital voltmeter between TP-13 and TP-16 (GND) of the Audio board. 2. Adjust R21 to set the bias level for 2.5 mVrms.
4	Audio Rec. Level	TP-15 Audio	R4 AUDIO	1 kHz –20 dB REC ↓ P.B.	1. Supply video input signal and audio input signal of 1 kHz –20 dB and record then play back. 2. During recording adjust R4 so that the audio output level during playback becomes –6 ± 1 dBs (0.98–1.23 Vp-p). 
5	Noise Cancel	Audio Line Out	R28 AUDIO	P.B.	1. Cover the end sensor with opaque material and lower the cassette housing without cassette. 2. Set for the play mode and adjust R28 for minimum output level.

5.7 MECHACON TROUBLESHOOTING

No Power Flowchart


No power; POWER LED does not light
Power on briefly
YES
SERVO F3 open; MECHACON board IC3 defective; R25 open; C3 shorted
NO
12 V at battery or AC adapter terminals
NO
Battery or AC adapter defective
YES
12 V at SERVO RY-1 pin 2 ?
NO
SERVO F1 open; Connector contacts defective
YES
12 V at SERVO CN-3 pin 1 ?
NO
SERVO F2 open
YES
5 V at SERVO CN-3 pin 8 ?
NO
YES
Briefly short SERVO Q13 (C); power obtained ?
NO
SERVO R 151 open; RY-1 open
40 kHz pulse at SW REG IC-3 pin 17 ?
NO
SW REG IC-3 defective
YES
Check SW REG TF1, TF2, Q1, L1, L5, L6, C1, C3, C9, C10, D2, IC-2.
YES
Press POWER button; low at SERVO Q19 (C) ?
NO
MECHACON S9, D17 open SERVO Q6, Q7 open; R115, R116 open
YES
SERVO Q8, Q9 open; C56 open R119, R120, R121 open D23 open

Emergency Mode Flowchart

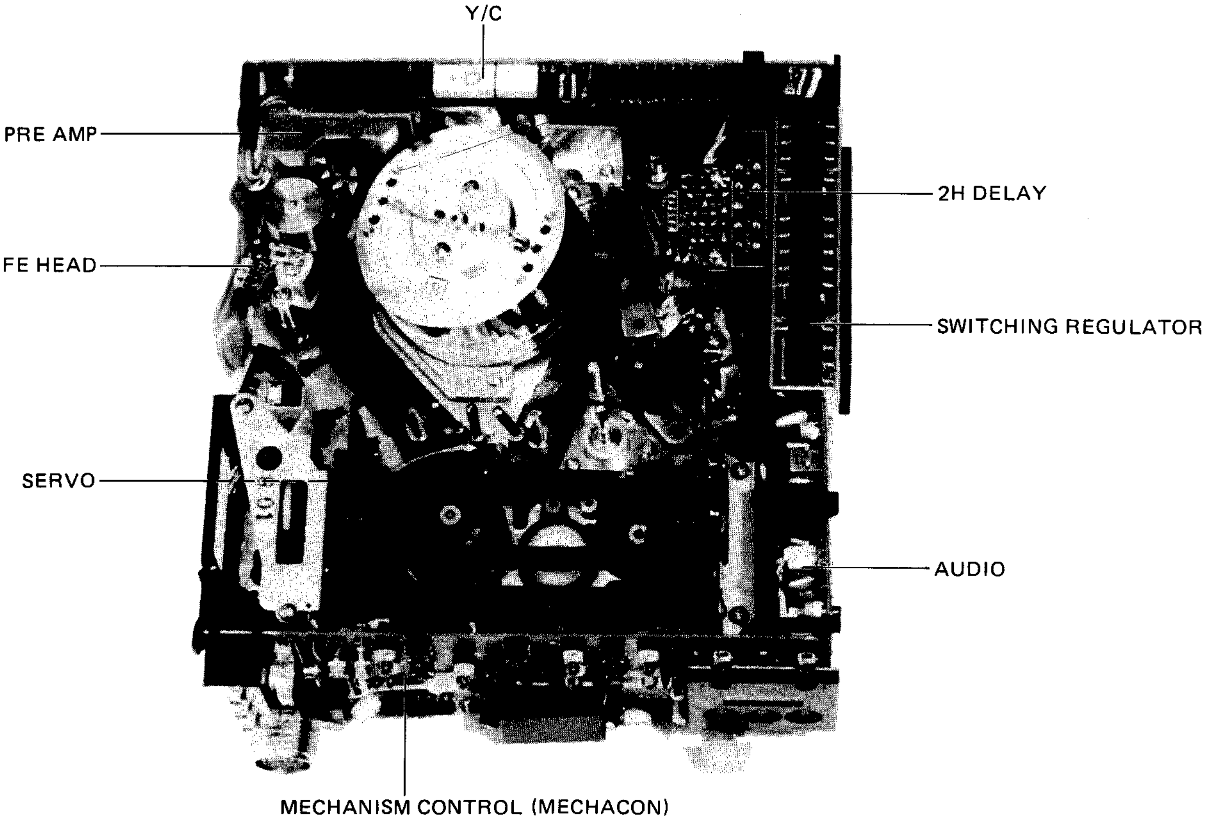


Emergency
Press PLAY; loading not performed; Emergency mode entered
YES
Solenoid inoperative
NO
Press PLAY; loading performed, then switches to unloading and stops in Emergency mode
YES
Reel motor inoperative
NO
Play normal, pressing PAUSE button yields Emergency mode
YES
Capstan motor rotates in pause mode
NO
Play normal; after STOP button pressed, Emergency mode entered in midst of unloading
YES
Supply reel sensor triggered
NO
In Emergency mode, even at unloading completion, tape cannot be removed
YES
UL switch on during loaded state
NO
FF normal; REW inoperative
YES
Take-up reel sensor triggered
Drum motor rotates?
NO
Drum motor inoperative
YES
Capstan motor rotates?
NO
Capstan motor inoperative
YES
Drum flipflop signal at SERVO board TP-3?
NO
Drum flipflop signal absent
YES
Capstan FG signal absent

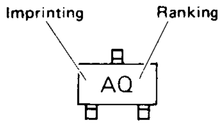
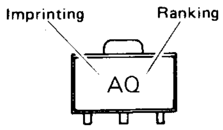
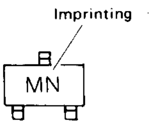
Automatic power shutoff occurs 150 seconds after the Emergency mode has been entered. Therefore, when checking the circuit, short C7 of the MECHACON board.

SECTION 6
CHARTS AND DIAGRAMS

6.1 CIRCUIT BOARD LOCATIONS


Y/C
PRE AMP
2H DELAY
FE HEAD
SWITCHING REGULATOR
SERVO
AUDIO
MECHANISM CONTROL (MECHACON)

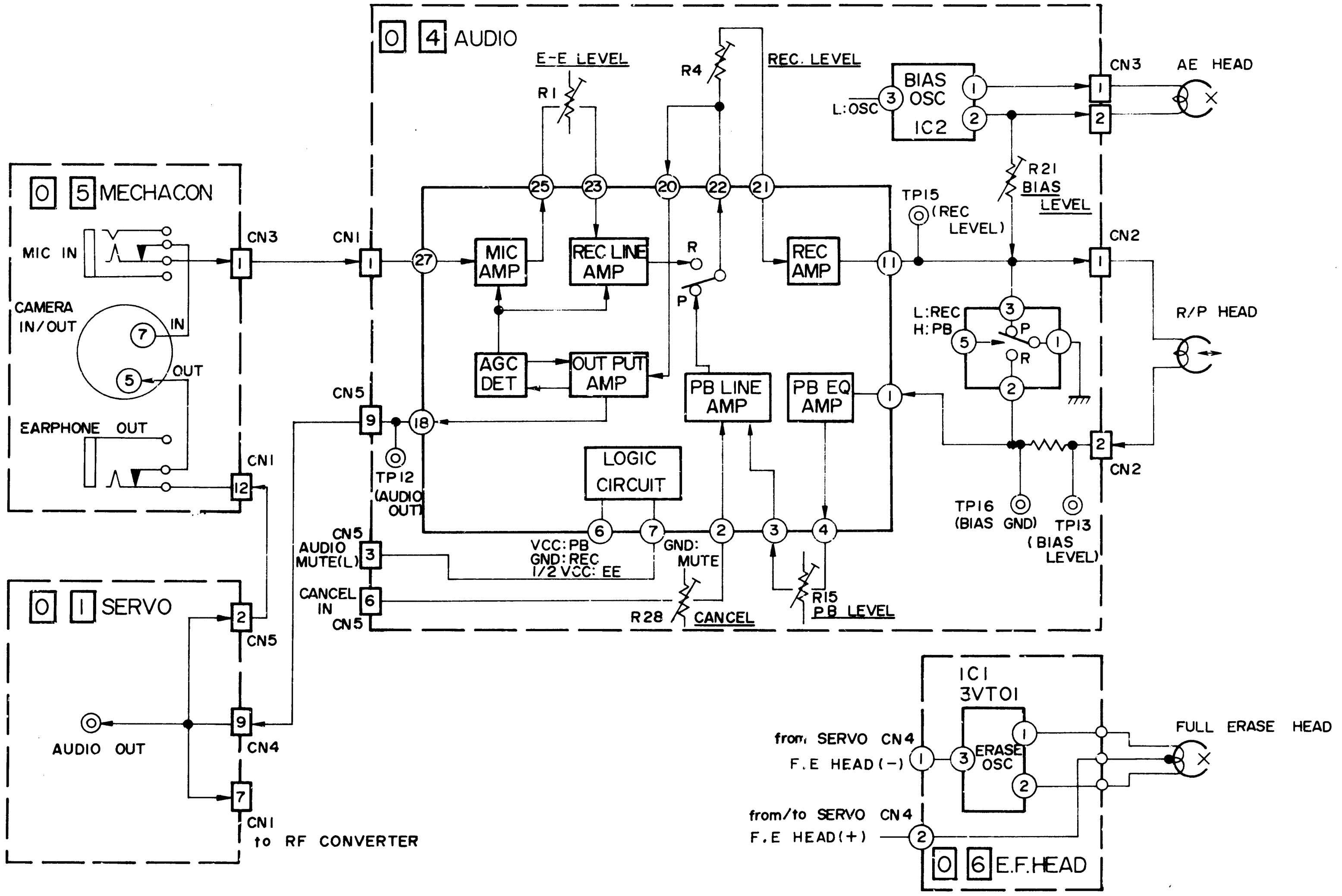
NOTE: Chip transistors and diodes used in this model are outlined as follows.

Transistors				Diodes	
Type	Imprinting	Type	Imprinting	Type	Imprinting
2SB709	A	2SB798	O	MA151WA	MN
2SB710	C	2SD999	C	MA151WK	MT
2SC2716	F	2SD1119	T		
2SC2757	T 32				
2SD601	Y				
2SD602	W				
 Imprinting Ranking AQ (Standard type)		 Imprinting Ranking AQ (Power type)		 Imprinting MN	

6.2 KEY TO ABBREVIATIO

A	AC	Alternating Current
	ACC	Automatic Color Control
	A/CTL	Audio/Control
	A. DUB	Audio Dubbing
	AE	Audio Erase
	AFC	Automatic Frequency Control
	AGC	Automatic Gain Control
	AL	After Loading
	AMP	Amplifier
	ANT	Antenna
	APC	Automatic Phase Control
	AUX	Auxiliary
B	B	Base
	BAL	Balance
	BLK	Black
	BLU	Blue
	BPF	Band-Pass Filter
	BRN	Brown
	B. SOL	Brake Solenoid
	B/W	Black and White
C	CAP	Capstan
	CARR	Carrier
	CASS	Cassette
	CD	Count Down
	CF	Ceramic Filter
	CH	Channel
	COL	Color (Colour)
	COMP	Comparator
	CONN	Connector
	CONV	Converter
	COUNT SEA	Counter Search
	C. PAUSE	Camera Pause
	C. SW	Cassette Switch
	CTL	Control
D	DAC	Digital to Analog Converter
	DEMOD	Demodulator
	DET	Detector
	DL	Delay Line
	DOC	Drop Out Compensator
	D. PU	Drum Pick-up
	DRUM FF	Drum Flip-Flop
E	EF	Emitter Follower
	EMPH	Emphasis
	EQ	Equalizer
	E. SENS	End Sensor
	E. SW	Electronic Switch
	EP	Extended Play
F	F	Fuse
	F. ADV	Frame Advance
	FE	Full Erase
	FF	Fast Forward Flip-Flop
	FG	Frequency Generator
	FM	Frequency Modulation
	FR	Full Recording
	FWD	Forward
G	GEN	Generator
	GND	Ground
	GRN	Green
	GRY	Gray
H	HG	Hall Generator
	HPF	High-Pass Filter
I	ID	Identification
	IF	Intermediate Frequency
	IND	Indicator
	INV	Inverter
J	–	–
K	–	–
L	LP	Long Play
	LED	Light Emitting Diode
	LOAD	Loading
	LPF	Low-Pass Filter
M	M.	Motor
	MDA	Motor Drive Amplifier
	MECHACON	Mechanism Control
	MIC	Microphone
	MIX	Mixer, Mixing
	MMV	Monostable Multivibrator
	MOD	Modulator
	MUTE	Muting
N	NC	Non Connection
	NON-LIN	Non-Linear
O	OP	Operation
	ORN	Orange
	OSC	Oscillator
P	PB	Playback
	PI	Photo Interrupter
	PR	Pinch Roller
	P/S	Pause/Still
	P. TR	Power Transistor
	PU	Pick-up
	PWB	Printed Wiring Board
Q	–	–
R	REC	Recording (Record)
	RED	Red
	REG	Regulator
	REV	Reverse
	REW	Rewind
	RF	Radio Frequency
	R/P	Record/Playback
	RT	Rotary Transformer
	RUN IND	Running Indicator
	RY	Relay
S	SAFE	Safety
	SEAR	Search
	SEC	Second
	SEL	Select
	SENS	Sensor
	SF	Source Follower
	SOL	Solenoid
	S. R	Supply Reel
	S. SENS	Start Sensor
	S. SEP	Sync Separator
	SWD	Switched
	SW	Switch
	SP	Standard Play
T	T. E ALM	Tape End Alarm
	TP	Test Point
	TR	Transistor
	TRANS	Transformer
	T. REC	Timer Record
	T. SW	Timer Switch
	T/T	Tuner/Timer
	TU	Take-up
	TU. R	Take-up Reel
U	UL	Unloading
	UNSWD	Unswitched
V	VCO	Voltage Controlled Oscillator
	VLT	Violet
	V. PULSE	Vertical Pulse
	V. SEL	Video Select
	V/T	Video/Television
	V/U	VHF/UHF
	VXO	Variable Crystal Oscillator
W	W	Watt
	W/D	White and Dark
	WHT	White
Y	Y	Luminance
	YLW	Yellow
Z	–	–

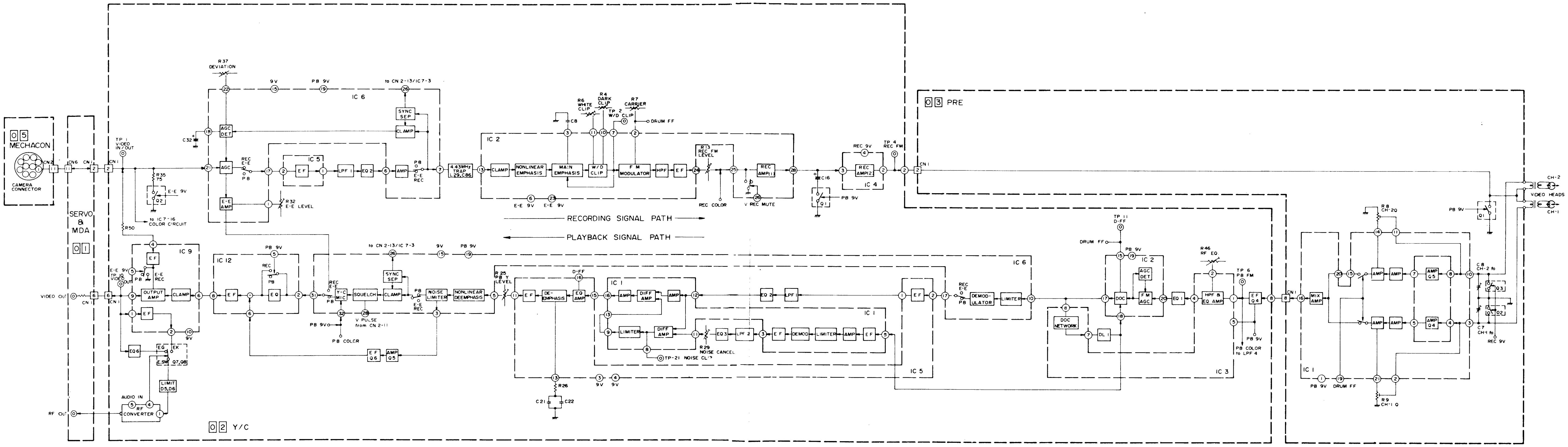
6.3 AUDIO BLOCK DIAGRAM


0 4 AUDIO
E-E LEVEL
R1
R4
REC. LEVEL
BIAS OSC
IC2
L:OSC
CN3
AE HEAD
R21
BIAS LEVEL
TP15
(REC LEVEL)
CN2
R/P HEAD
0 5 MECHACON
MIC IN
CAMERA IN/OUT
IN
OUT
EARPHONE OUT
CN3
CN1
MIC AMP
REC LINE AMP
R
P
REC AMP
L:REC
H:PB
AGC DET
OUT PUT AMP
PB LINE AMP
PB EQ AMP
CN5
TP12
(AUDIO OUT)
LOGIC CIRCUIT
CN2
TP16
(BIAS GND)
TP13
(BIAS LEVEL)
CN5
AUDIO MUTE(L)
VCC: PB
GND: REC
1/2 VCC: EE
GND: MUTE
CANCEL IN
CN5
R28
CANCEL
R15
PB LEVEL
0 1 SERVO
CN5
AUDIO OUT
CN4
CN1
to RF CONVERTER
IC1
3VT01
ERASE OSC
FULL ERASE HEAD
from SERVO CN4
F.E HEAD(−)
from/to SERVO CN4
F.E HEAD(+)
0 6 E.F.HEAD

6-3 AUDIO BLOCK
(VIDEO BLOCK)(Luminance)

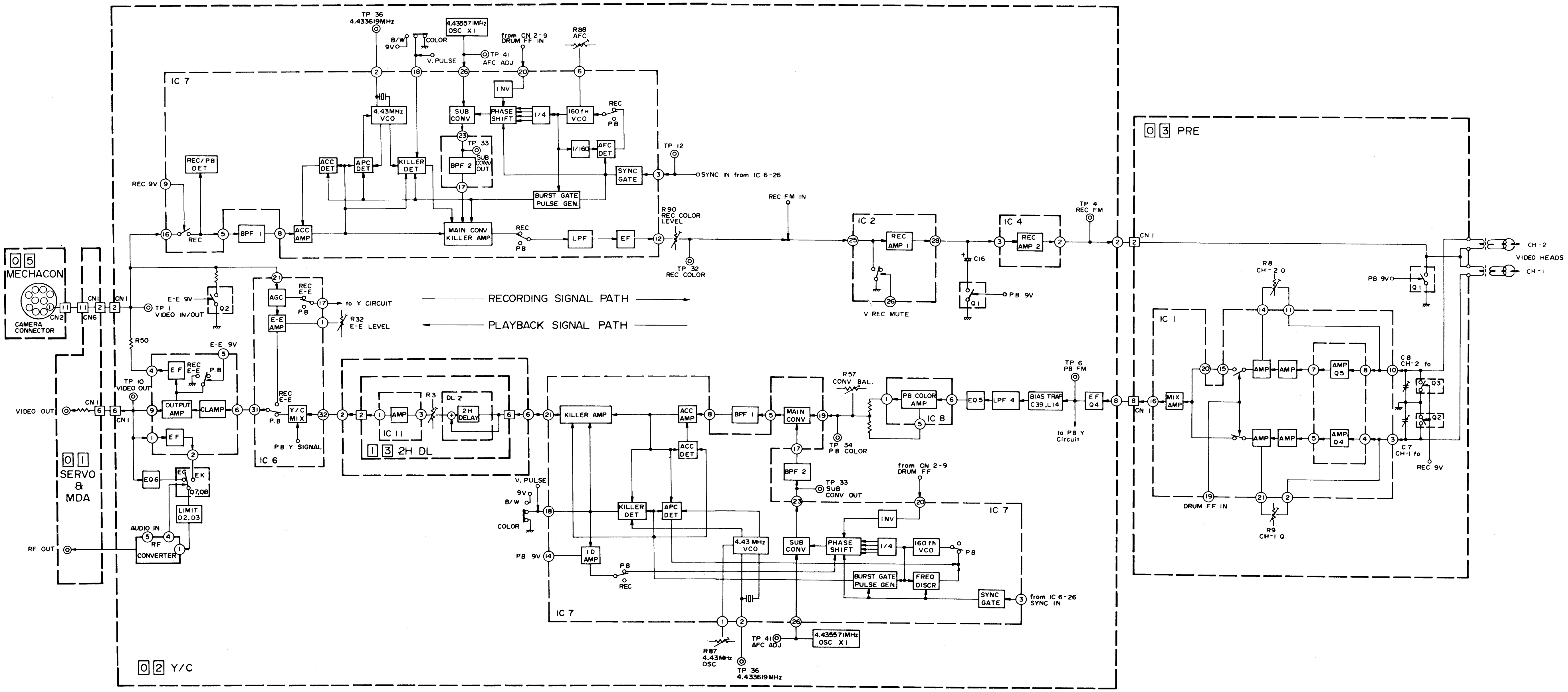
6.4 VIDEO BLOCK DIAGRAM

6.4.1 Luminance signal system

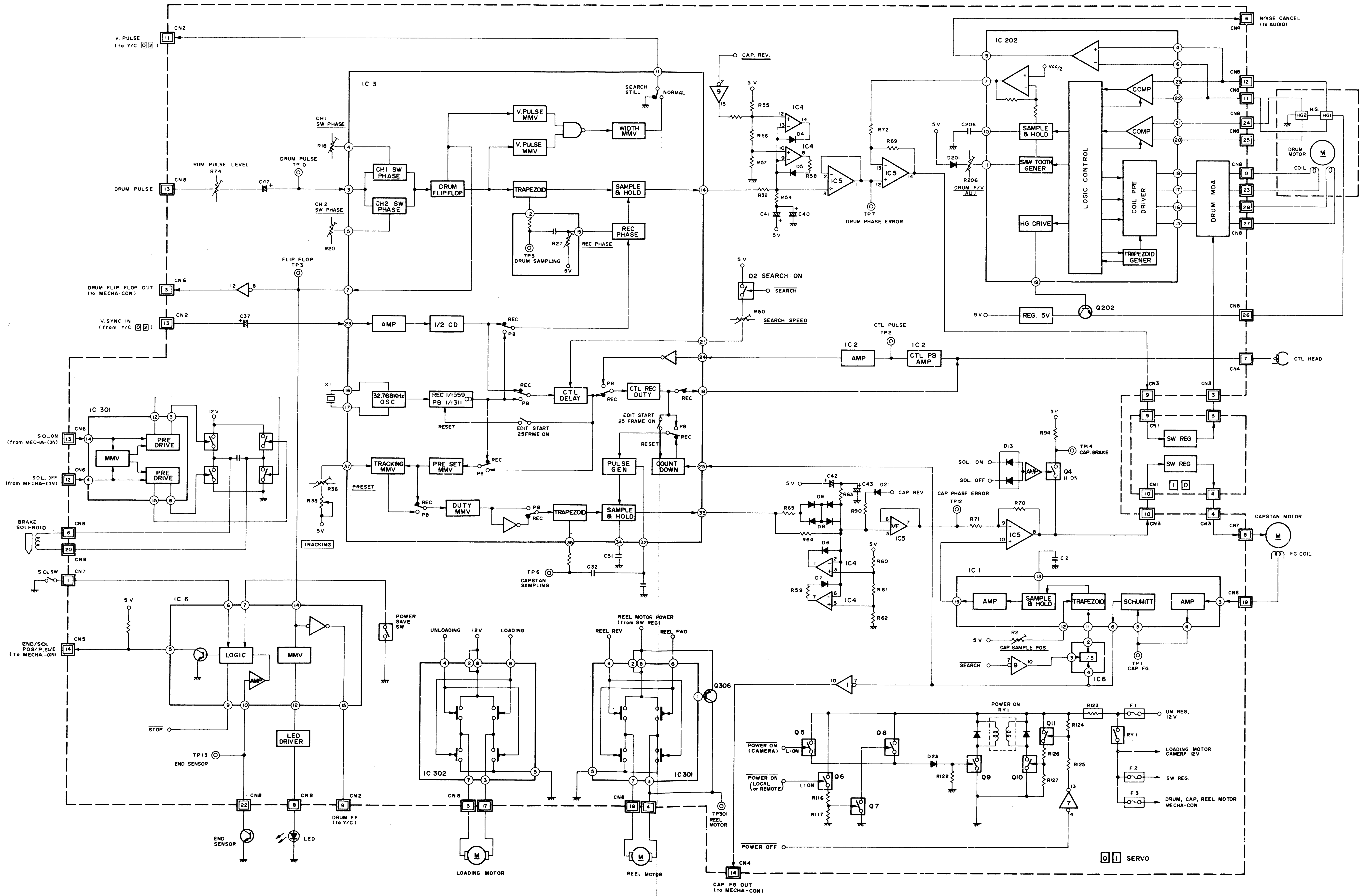

05 MECHACON
CAMERA CONNECTOR
CN2
CN6
CN1
SERVO & MDA
01
TP 1 VIDEO IN/OUT
R35 75
E-E 9V
Q2
to IC 7-16 COLOR CIRCUIT
R50
R37 DEVIATION
9V
PB 9V
to CN 2-13/IC7-3
IC 6
C32
AGC DET
AGC
E-E AMP
SYNC SEP
CLAMP
REC E-E PB
IC 5
EF
LPF 1
EQ 2
AMP
PB E-E REC
R32 E-E LEVEL
4.43MHz TRAP L29,C86
IC 2
CLAMP
NONLINEAR EMPHASIS
MAIN EMPHASIS
W/D CLIP
F M MODULATOR
HPF
E F
R6 WHITE CLIP
R4 DARK CLIP
TP 2 W/D CLIP
R7 CARRIER
DRUM FF
C8
E-E 9V
E-E 9V
R13 REC FM LEVEL
REC AMP(1)
REC COLOR
V REC MUTE
C16
Q1
PB 9V
REC 9V
REC AMP(2)
IC 4
TP 4 REC FM
RECORDING SIGNAL PATH
PLAYBACK SIGNAL PATH
03 PRE
IC 9
E-E 9V
TP 10 VIDEO OUT
PB
E-E REC
OUTPUT AMP
CLAMP
VIDEO OUT
RF OUT
EQ6
EG
EK
E.SW Q7,Q8
LIMIT D5,D6
AUDIO IN
RF CONVERTER
IC 12
PB 9V
REC
PB
EQ
REC E-E PB
Y-C MIC
SQUELCH
SYNC SEP
CLAMP
NOISE LIMITER
NONLINEAR DEEMPHASIS
PB 9V
V PULSE from CN 2-11
PB COLOR
EF Q6
AMP Q5
R25 PB Y LEVEL
D-FF
DE-EMPHASIS
EQ AMP
IC 1
AMP
DIFF AMP
LIMITER
TP-21 NOISE CLIP
R29 NOISE CANCEL
EQ3
LPF 2
DEMOD
R26
C21
C22
IC 5
REC E-E PB
DEMOD-ULATOR
LIMITER
TP 11 D-FF
DRUM FF
IC 2
AGC DET
DOC
FM AGC
EQ 1
DOC NETWORK
DL 1
IC 3
R46 RF EQ
HPF & EQ AMP
TP 6 PB FM
EF Q4
PB 9V
PB COLOR to LPF 4
02 Y/C
MIX AMP
AMP Q5
AMP Q4
R8 CH-2Q
R9 CH-1 Q
PB 9V
DRUM FF
C8 CH-2 fo
C7 CH-1 fo
Q3
Q2
REC 9V
Q1
CH-2
VIDEO HEADS
CH-1

6-4 VIDEO BLOCK(Luminance)
(AUDIO BLOCK)

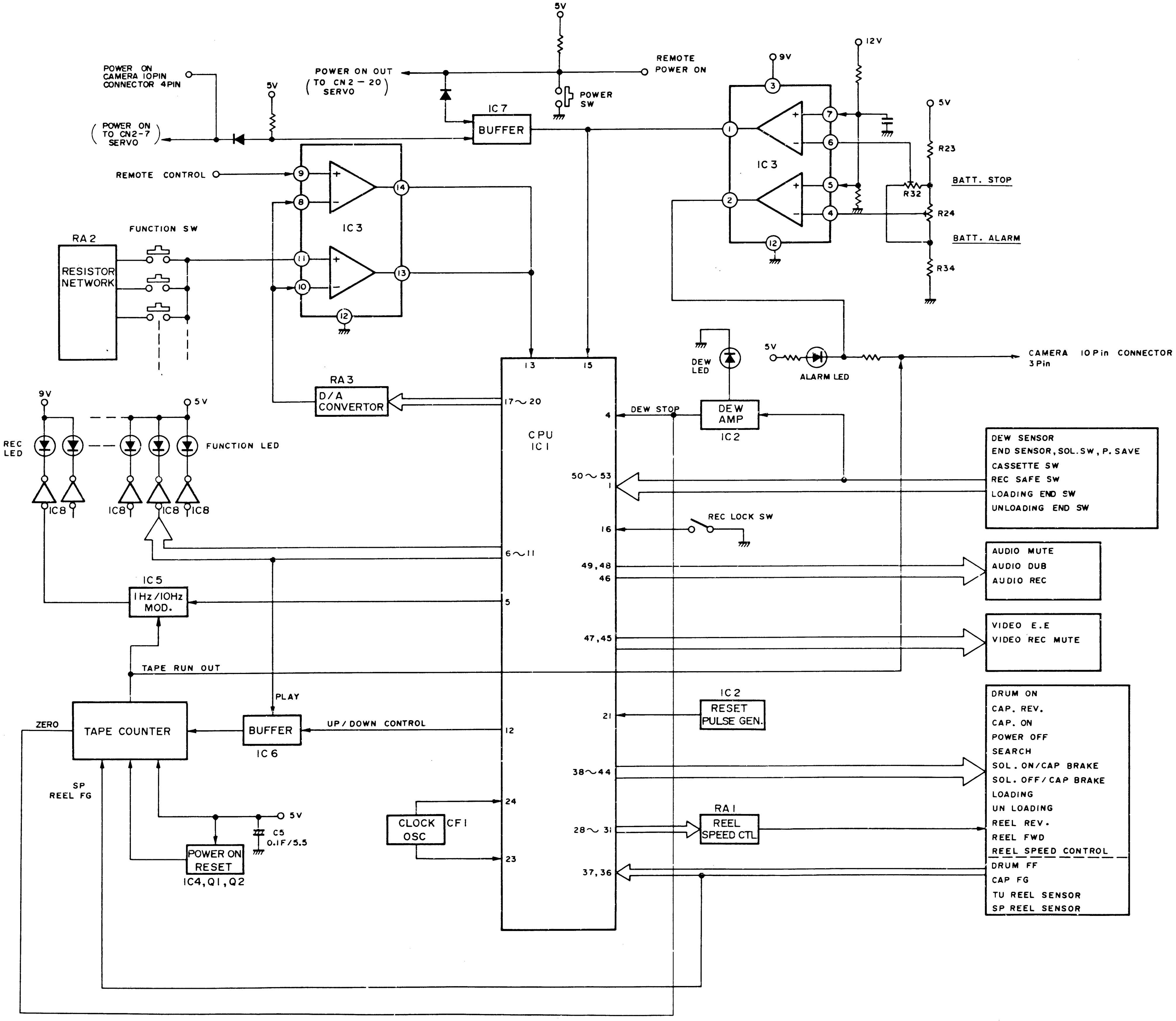
6.4.2 Color signal system

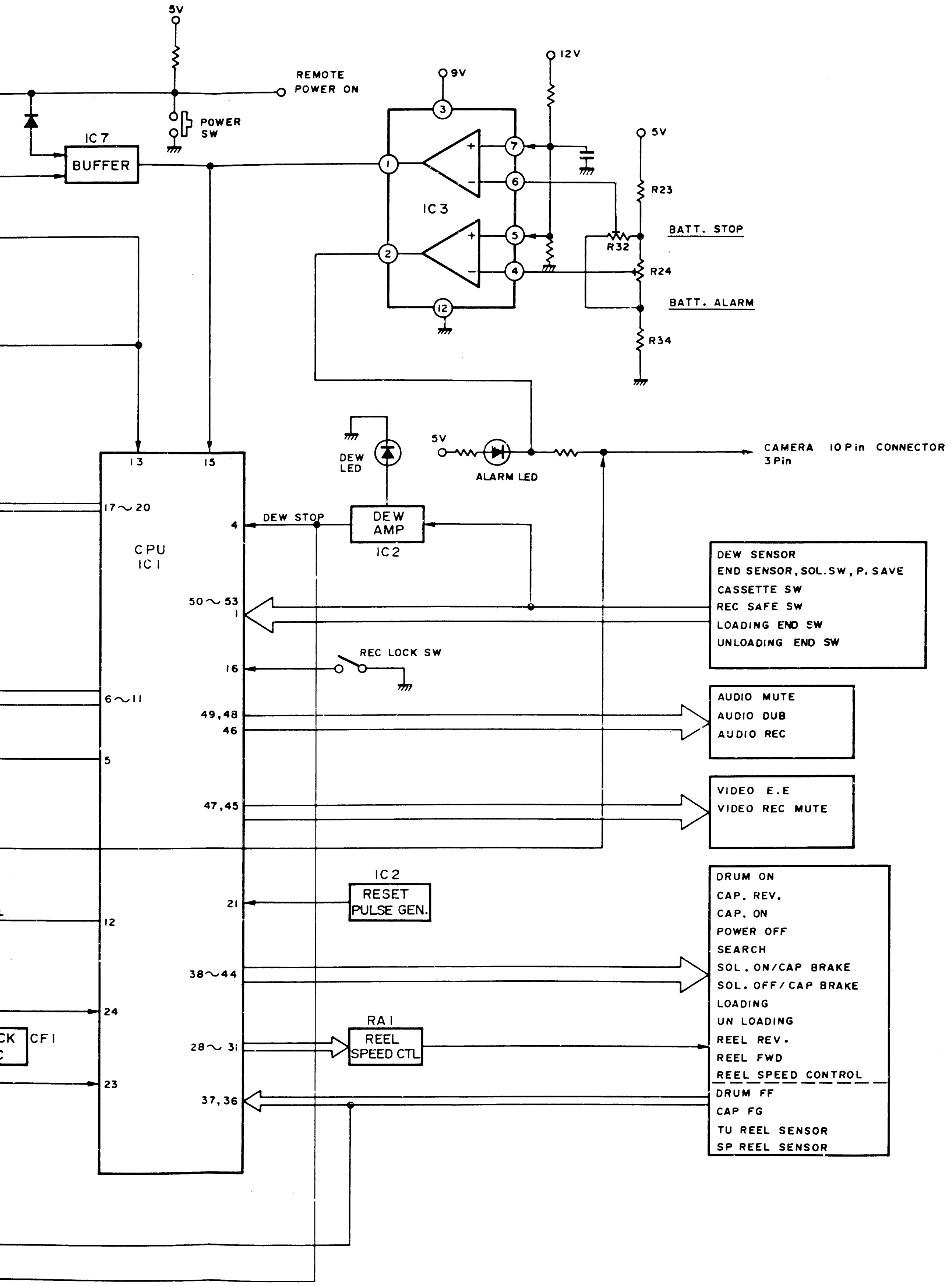

05 MECHACON
CAMERA CONNECTOR
CN2
CN6
CN1
TP 1 VIDEO IN/OUT
E-E 9V
Q2
R50
01 SERVO & MDA
VIDEO OUT
RF OUT
TP 10 VIDEO OUT
E F
REC E-E
P.B
OUTPUT AMP
CLAMP
EQ6
EG
EK
Q7,Q8
LIMIT D2,D3
AUDIO IN
RF CONVERTER
02 Y/C
IC 7
REC 9V
REC/PB DET
REC
BPF 1
ACC AMP
ACC DET
APC DET
KILLER DET
4.43MHz VCO
TP 36 4.433619MHz
B/W 9V
COLOR
V. PULSE
4.435571MHz OSC X1
TP 41 AFC ADJ
from CN 2-9 DRUM FF IN
R88 AFC
INV
SUB CONV
PHASE SHIFT
1/4
160 fH VCO
PB
TP 33 SUB CONV OUT
BPF 2
1/160
AFC DET
SYNC GATE
BURST GATE PULSE GEN.
MAIN CONV KILLER AMP
LPF
EF
TP 12
SYNC IN from IC 6-26
R90 REC COLOR LEVEL
TP 32 REC COLOR
IC 6
AGC
E-E AMP
to Y CIRCUIT
R32 E-E LEVEL
Y/C MIX
PB Y SIGNAL
RECORDING SIGNAL PATH
PLAYBACK SIGNAL PATH
13 2H DL
IC 11
AMP
R3
DL 2
2H DELAY
KILLER AMP
ID AMP
PB 9V
FREQ DISCR
from IC 6-26 SYNC IN
R87 4.43MHz OSC
MAIN CONV
TP 34 PB COLOR
R57 CONV BAL.
PB COLOR AMP
IC 8
EQ5
LPF 4
BIAS TRAP C39,L14
TP 6 PB FM
EF Q4
to PB Y Circuit
from CN 2-9 DRUM FF
REC FM IN
IC 2
REC AMP 1
V REC MUTE
C16
Q1
IC 4
REC AMP 2
TP 4 REC FM
03 PRE
IC 1
MIX AMP
AMP
AMP Q5
AMP Q4
R8 CH-2 Q
R9 CH-1 Q
DRUM FF IN
C8 CH-2 fo
C7 CH-1 fo
Q3
REC 9V
CH-2
CH-1
VIDEO HEADS

6.5 SERVO BLOCK DIAGRAM


A
B
C
D
E
F
G
H
1
2
3
4
5
6
V. PULSE (to Y/C)
CN2
DRUM PULSE
CN8
DRUM FLIP FLOP OUT (to MECHA-CON)
CN6
V. SYNC IN (from Y/C)
RUM PULSE LEVEL R74
C47
DRUM PULSE TP10
CH1 SW PHASE
R18
CH2 SW PHASE
R20
FLIP FLOP TP3
IC 3
CH1 SW PHASE
CH2 SW PHASE
DRUM FLIPFLOP
V.PULSE MMV
V. PULSE MMV
WIDTH MMV
TRAPEZOID
SAMPLE & HOLD
REC PHASE
R27
TP5 DRUM SAMPLING
SEARCH STILL
NORMAL
AMP
1/2 CD
REC
PB
C37
X1
32.768KHz OSC
REC 1/1559 PB 1/1311 CD
RESET
EDIT START 25FRAME ON
CTL DELAY
CTL REC DUTY
EDIT START 25 FRAME ON
PULSE GEN
COUNT DOWN
TRACKING MMV
PRE SET MMV
DUTY MMV
PRESET
P36
R38
TRACKING
TP6 CAPSTAN SAMPLING
C32
C31
IC 301
PRE DRIVE
MMV
PRE DRIVE
12V
SOL ON (from MECHA-CON)
SOL. OFF (from MECHA-CON)
BRAKE SOLENOID
SOL SW
CN7
IC 6
LOGIC
AMP
MMV
LED DRIVER
POWER SAVE SW
END/SOL POS/P.SAVE (to MECHA-CON)
CN5
STOP
TP13
END SENSOR
DRUM FF (to Y/C)
LED
UNLOADING
LOADING
IC 302
LOADING MOTOR
REEL MOTOR POWER (from SW REG)
REEL REV
REEL FWD
IC 301
Q306
TP301 REEL MOTOR
REEL MOTOR
CAP. REV.
5V
R55
IC4
R56
D4
D5
R57
R58
R32
R54
C41
C40
IC5
TP7 DRUM PHASE ERROR
R72
R69
C206
D201
R206 DRUM F/V ADJ
Q2 SEARCH: ON
SEARCH
R50
SEARCH SPEED
CTL PULSE TP2
IC 2 AMP
IC 2 CTL PB AMP
IC 202
Vcc/2
SAMPLE & HOLD
SAW TOOTH GENER
HG DRIVE
LOGIC CONTROL
COMP
COIL PRE DRIVER
DRUM MDA
TRAPEZOID GENER
REG. 5V
9V
Q202
NOISE CANCEL (to AUDIO)
CN4
HG
HG2
HG1
DRUM MOTOR
COIL
CTL HEAD
CN3
SW REG
SW REG
CN1
D13
AMP
Q4 H:ON
SOL. ON
SOL. OFF
R94
TP14 CAP. BRAKE
C42
C43
D21
CAP. REV
D9
D8
R63
R65
R64
R90
F/V
D6
D7
R59
R60
R61
R62
CAP. PHASE ERROR TP12
R70
R71
C2
CAPSTAN MOTOR
FG COIL
IC 1
AMP
SAMPLE & HOLD
TRAPEZOID
SCHUMITT
AMP
R2
CAP SAMPLE POS.
1/3
IC6
TP1 CAP FG.
POWER ON RY1
R123
F1
UN REG. 12V
Q11
R124
Q5
POWER ON (CAMERA) L:ON
Q8
D23
R122
Q9
Q10
R126
R125
R127
RY1
LOADING MOTOR CAMERA 12V
F2
SW. REG.
F3
DRUM, CAP, REEL MOTOR MECHA-CON
POWER ON (LOCAL or REMOTE) L:ON
Q6
R116
R117
Q7
POWER OFF
CAP FG OUT (to MECHA-CON)
SERVO

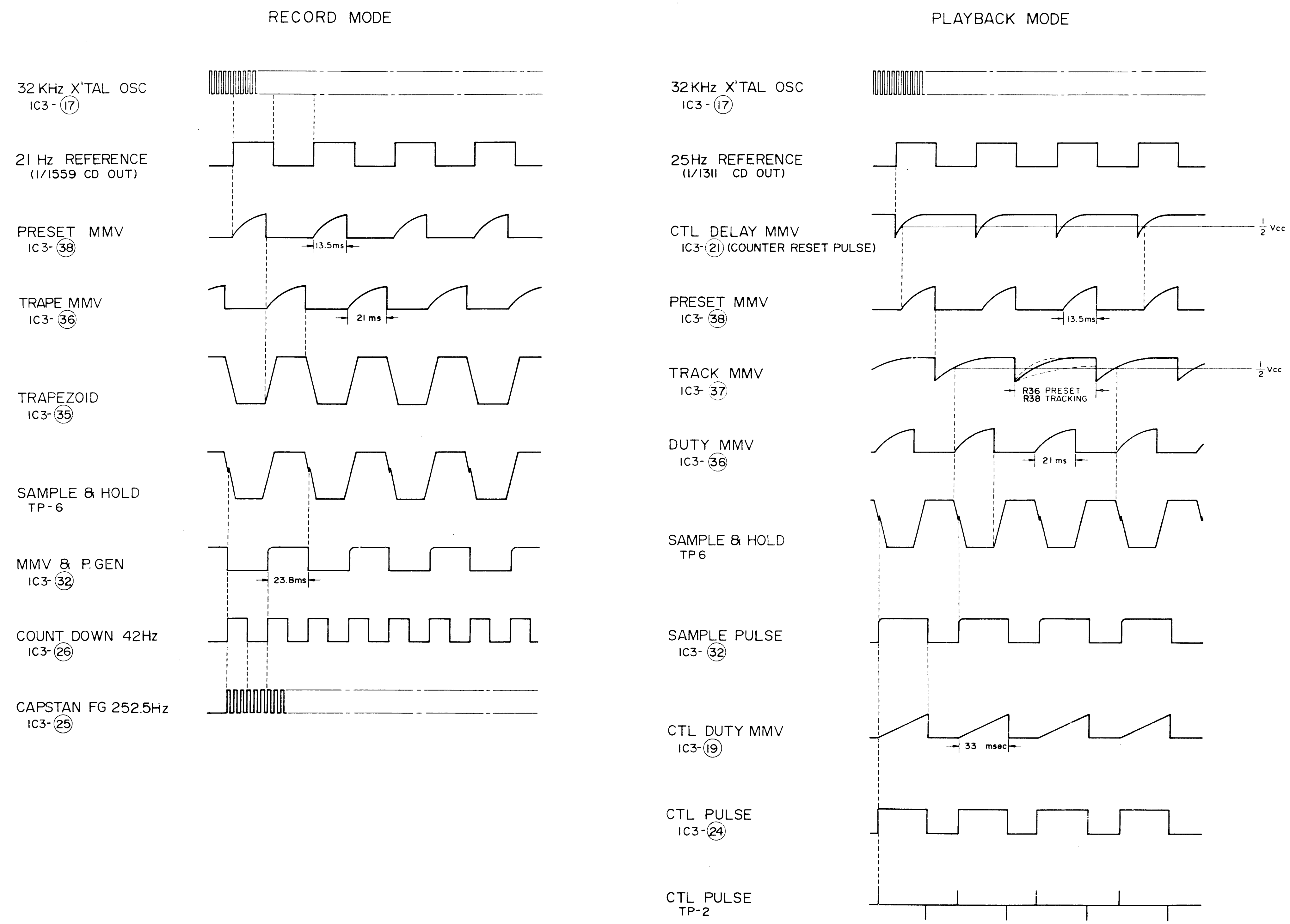
6.6 MECHANISM CONTROL BLOCK DIAGRAM


POWER ON CAMERA 10PIN CONNECTOR 4PIN
POWER ON TO CN2-7 SERVO
5V
POWER ON OUT (TO CN2 − 20 SERVO)
5V
REMOTE POWER ON
POWER SW
IC7
BUFFER
REMOTE CONTROL
9
8
14
11
10
13
12
IC3
RA2
RESISTOR NETWORK
FUNCTION SW
9V
12V
5V
3
7
6
1
5
2
4
12
IC3
R23
R32
BATT. STOP
R24
BATT. ALARM
R34
RA3
D/A CONVERTOR
13
15
17∼20
CPU IC1
9V
5V
REC LED
FUNCTION LED
IC8
IC8
IC8
IC8
DEW LED
5V
ALARM LED
CAMERA 10Pin CONNECTOR 3Pin
DEW STOP
4
DEW AMP
IC2
50∼53
1
DEW SENSOR
END SENSOR, SOL. SW, P. SAVE
CASSETTE SW
REC SAFE SW
LOADING END SW
UNLOADING END SW
16
REC LOCK SW
6∼11
49,48
46
AUDIO MUTE
AUDIO DUB
AUDIO REC
IC5
1Hz/10Hz MOD.
5
47,45
VIDEO E.E
VIDEO REC MUTE
TAPE RUN OUT
PLAY
IC2
RESET PULSE GEN.
21
ZERO
TAPE COUNTER
BUFFER
IC6
UP/DOWN CONTROL
12
SP REEL FG
5V
C5 0.1F/5.5
POWER ON RESET
IC4, Q1, Q2
CLOCK OSC
CF1
24
23
38∼44
RA1
REEL SPEED CTL
28∼31
37,36
DRUM ON
CAP. REV.
CAP. ON
POWER OFF
SEARCH
SOL. ON/CAP BRAKE
SOL. OFF/CAP BRAKE
LOADING
UN LOADING
REEL REV.
REEL FWD
REEL SPEED CONTROL
DRUM FF
CAP FG
TU REEL SENSOR
SP REEL SENSOR


5V
REMOTE POWER ON
POWER SW
IC7
BUFFER
9V
12V
5V
IC3
R23
R32
BATT. STOP
R24
BATT. ALARM
R34
DEW LED
5V
ALARM LED
CAMERA 10Pin CONNECTOR 3Pin
13
15
17～20
CPU IC1
4
DEW STOP
DEW AMP
IC2
50～53
1
DEW SENSOR
END SENSOR, SOL.SW, P.SAVE
CASSETTE SW
REC SAFE SW
LOADING END SW
UNLOADING END SW
16
REC LOCK SW
6～11
49,48
46
AUDIO MUTE
AUDIO DUB
AUDIO REC
5
47,45
VIDEO E.E
VIDEO REC MUTE
IC2
RESET PULSE GEN.
21
12
38～44
DRUM ON
CAP. REV.
CAP. ON
POWER OFF
SEARCH
SOL. ON/CAP BRAKE
SOL. OFF/CAP BRAKE
LOADING
UN LOADING
REEL REV.
REEL FWD
REEL SPEED CONTROL
24
CK
C
CF1
28～31
RA1
REEL SPEED CTL
23
37,36
DRUM FF
CAP FG
TU REEL SENSOR
SP REEL SENSOR

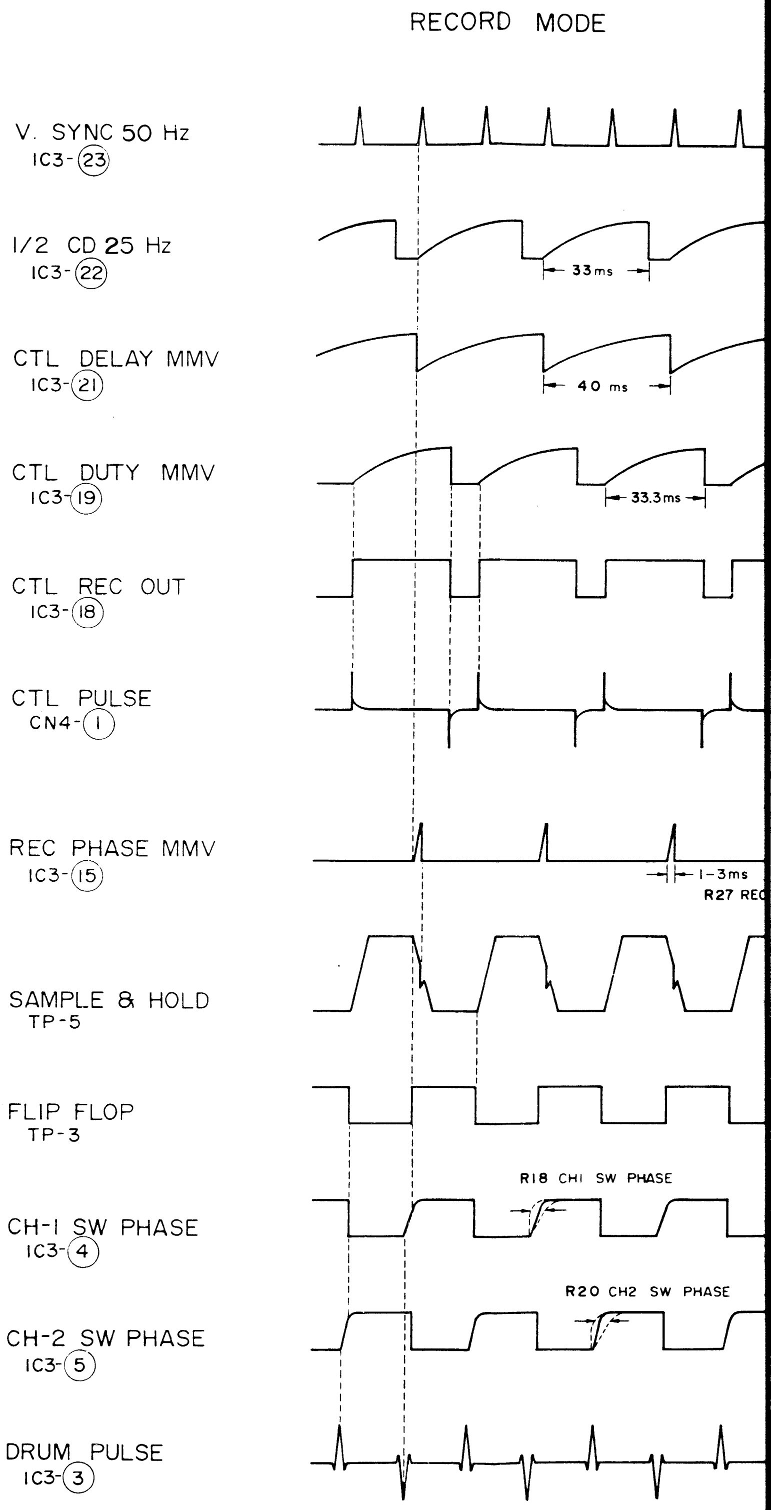
6.7 SERVO TIMING CHARTS

CAPSTAN SERVO TIMING CHART


RECORD MODE

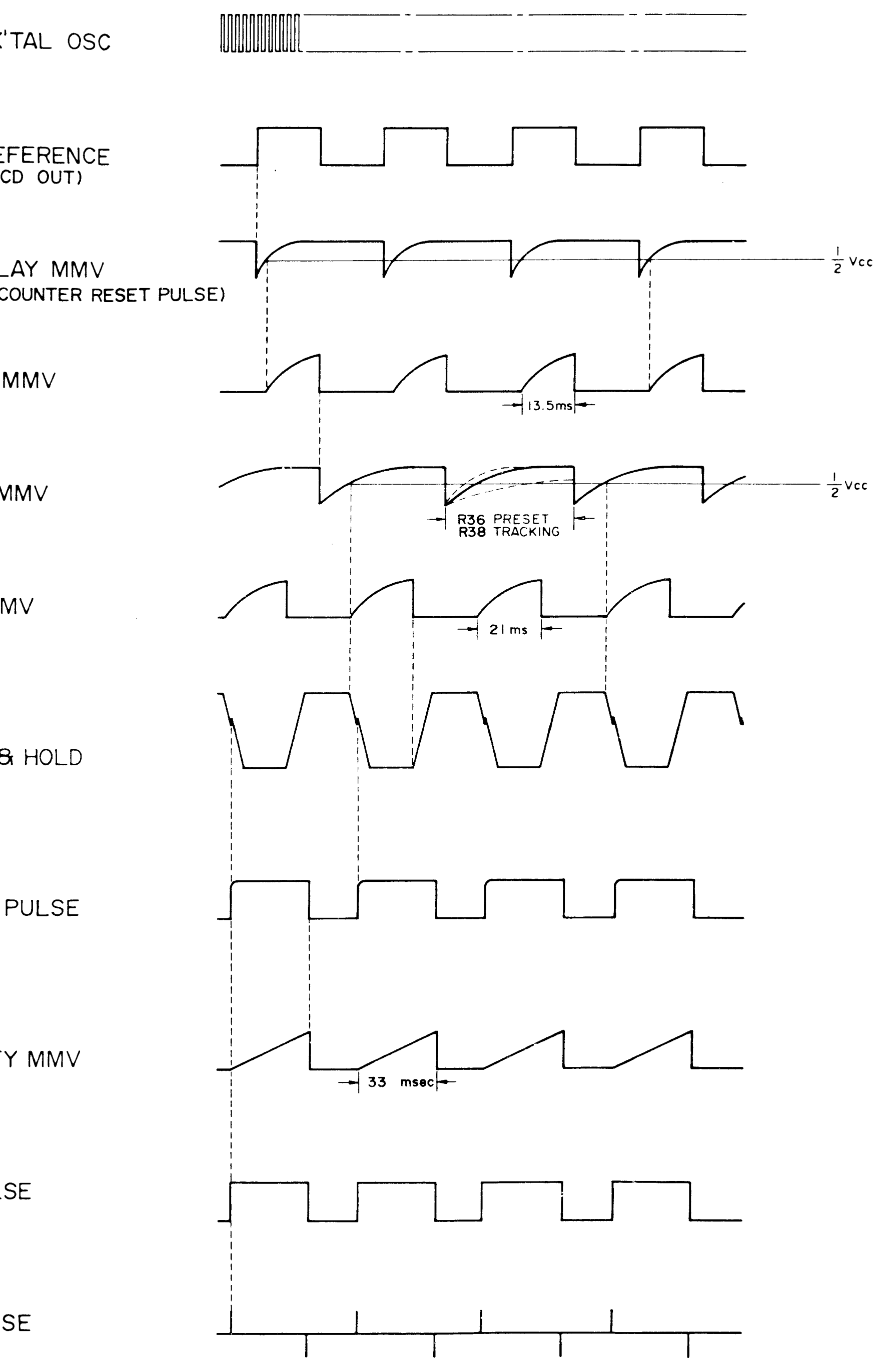
PLAYBACK MODE

DRUM SERVO TIMING CHART

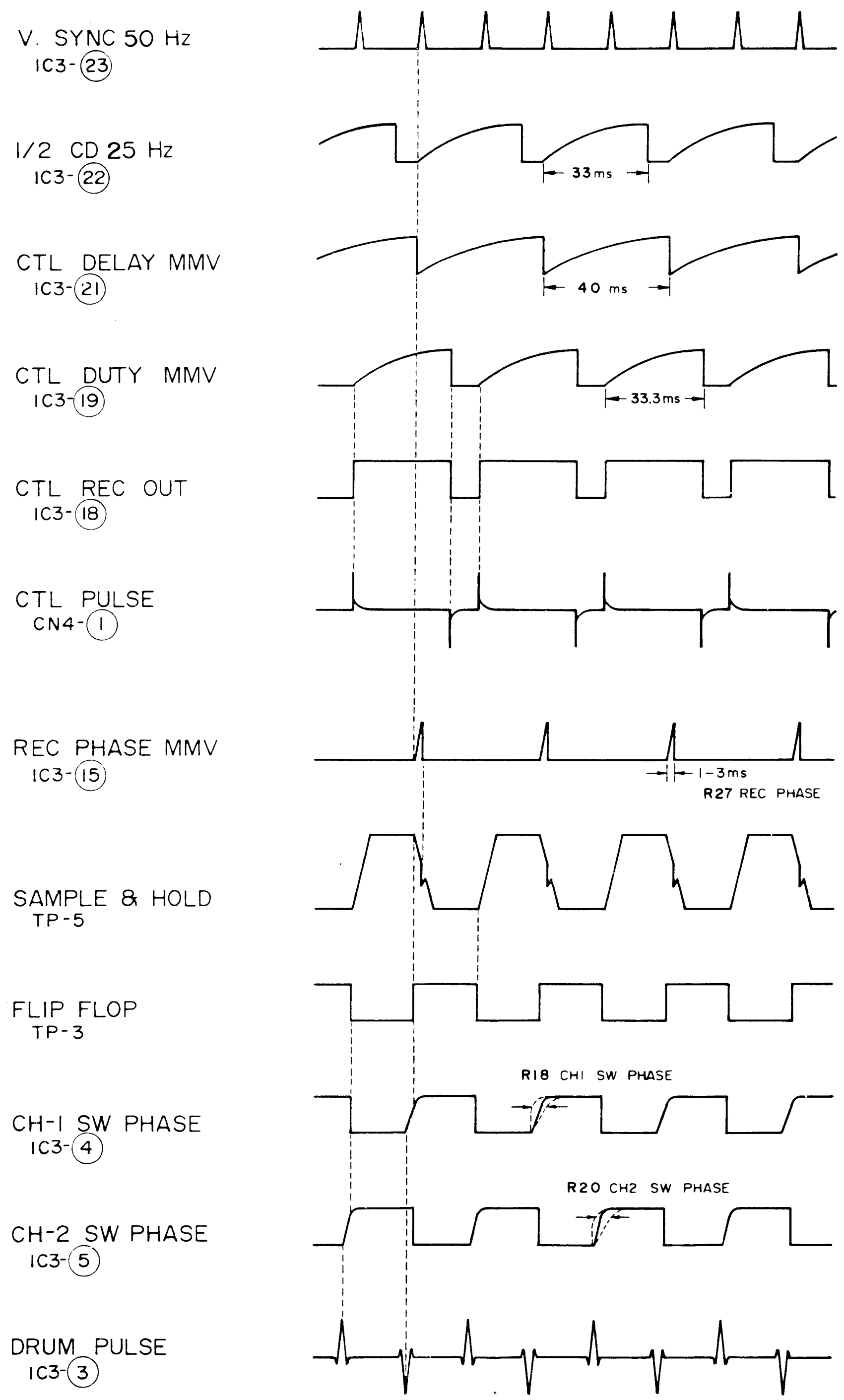

RECORD MODE

DRUM SERVO TIMING CHART

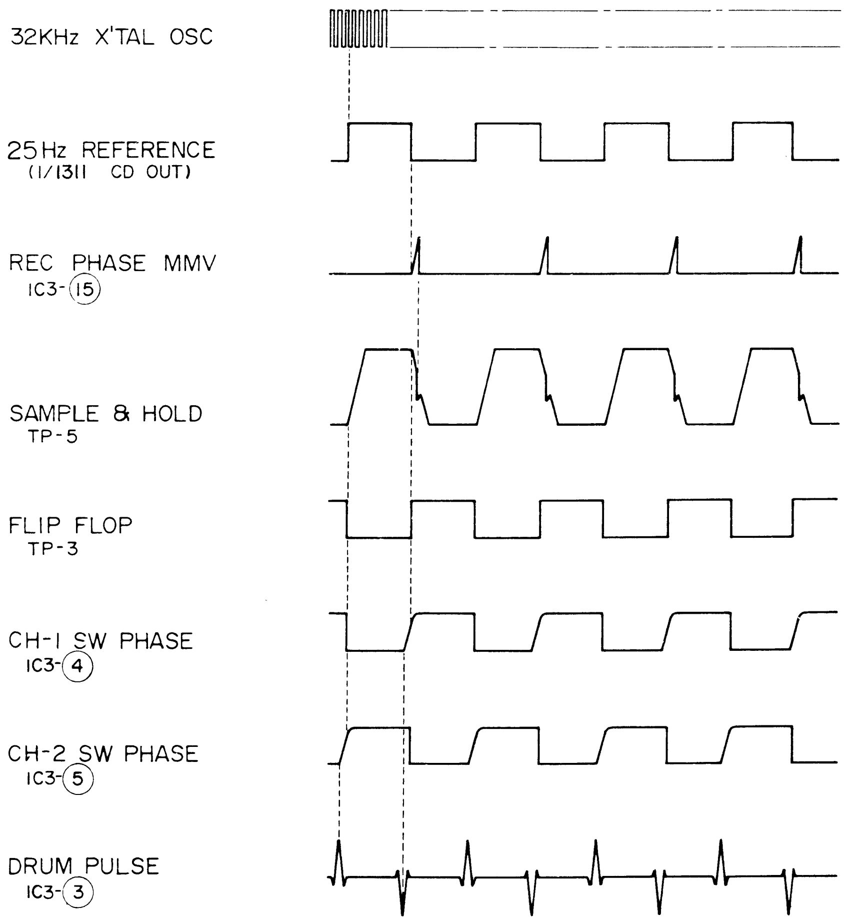
PLAYBACK MODE


'TAL OSC
EFERENCE
CD OUT)
LAY MMV
COUNTER RESET PULSE)
$\frac{1}{2}$ Vcc
MMV
13.5ms
MMV
$\frac{1}{2}$ Vcc
R36 PRESET
R38 TRACKING
MV
21 ms
& HOLD
PULSE
Y MMV
33 msec
SE
SE

RECORD MODE

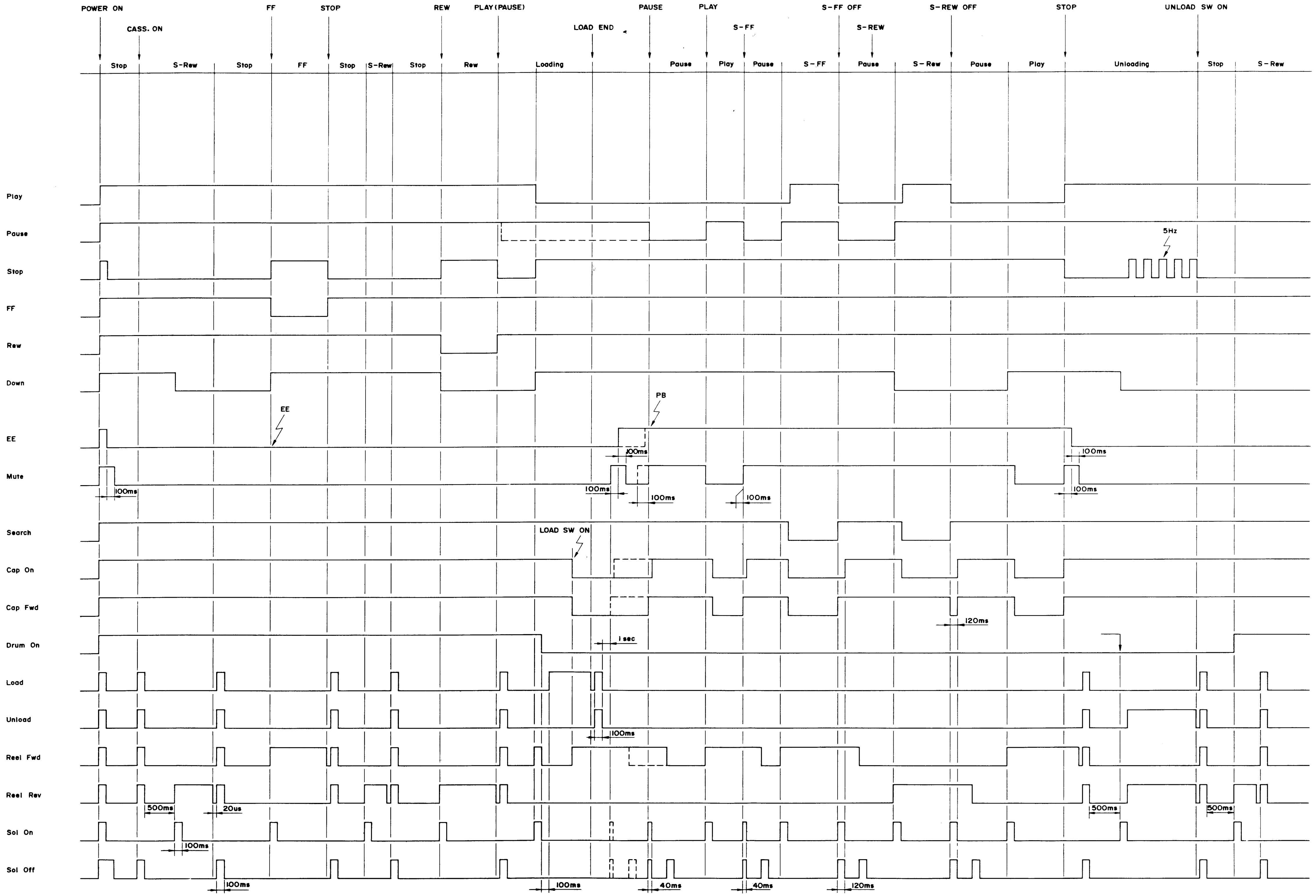

V. SYNC 50 Hz
IC3-㉓
1/2 CD 25 Hz
IC3-㉒
33ms
CTL DELAY MMV
IC3-㉑
40 ms
CTL DUTY MMV
IC3-⑲
33.3ms
CTL REC OUT
IC3-⑱
CTL PULSE
CN4-①
REC PHASE MMV
IC3-⑮
1-3ms
R27 REC PHASE
SAMPLE & HOLD
TP-5
FLIP FLOP
TP-3
R18 CH1 SW PHASE
CH-1 SW PHASE
IC3-④
R20 CH2 SW PHASE
CH-2 SW PHASE
IC3-⑤
DRUM PULSE
IC3-③

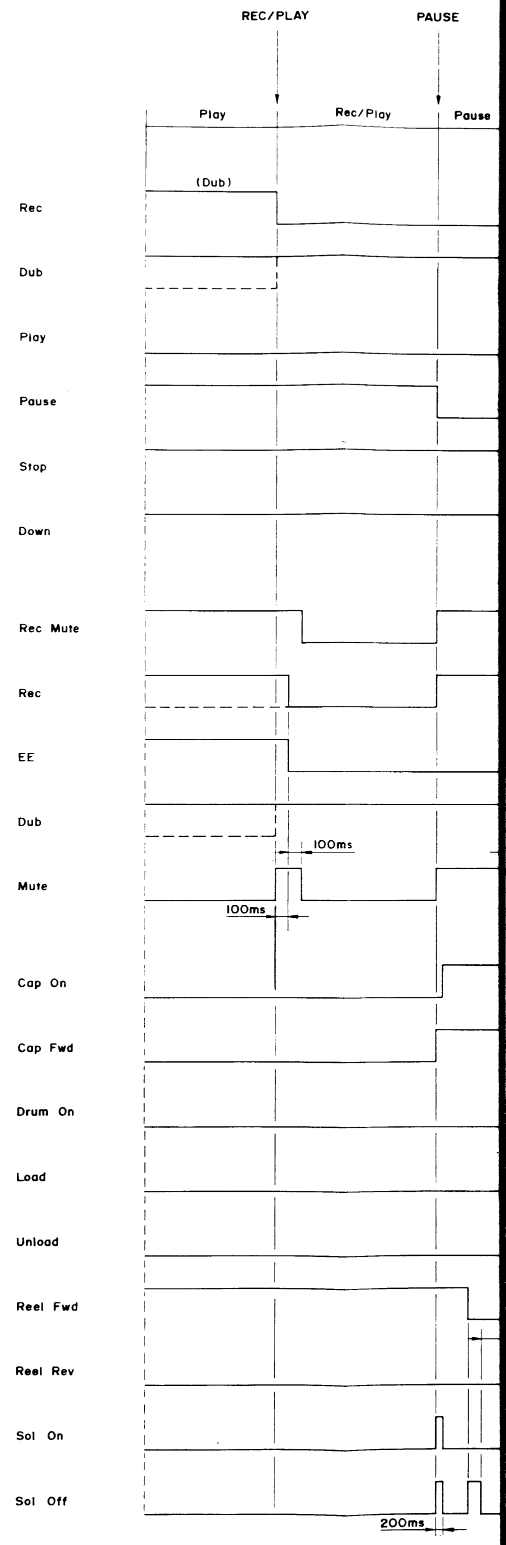
PLAYBACK MODE


32KHz X'TAL OSC
25Hz REFERENCE
(1/1311 CD OUT)
REC PHASE MMV
IC3-⑮
SAMPLE & HOLD
TP-5
FLIP FLOP
TP-3
CH-1 SW PHASE
IC3-④
CH-2 SW PHASE
IC3-⑤
DRUM PULSE
IC3-③

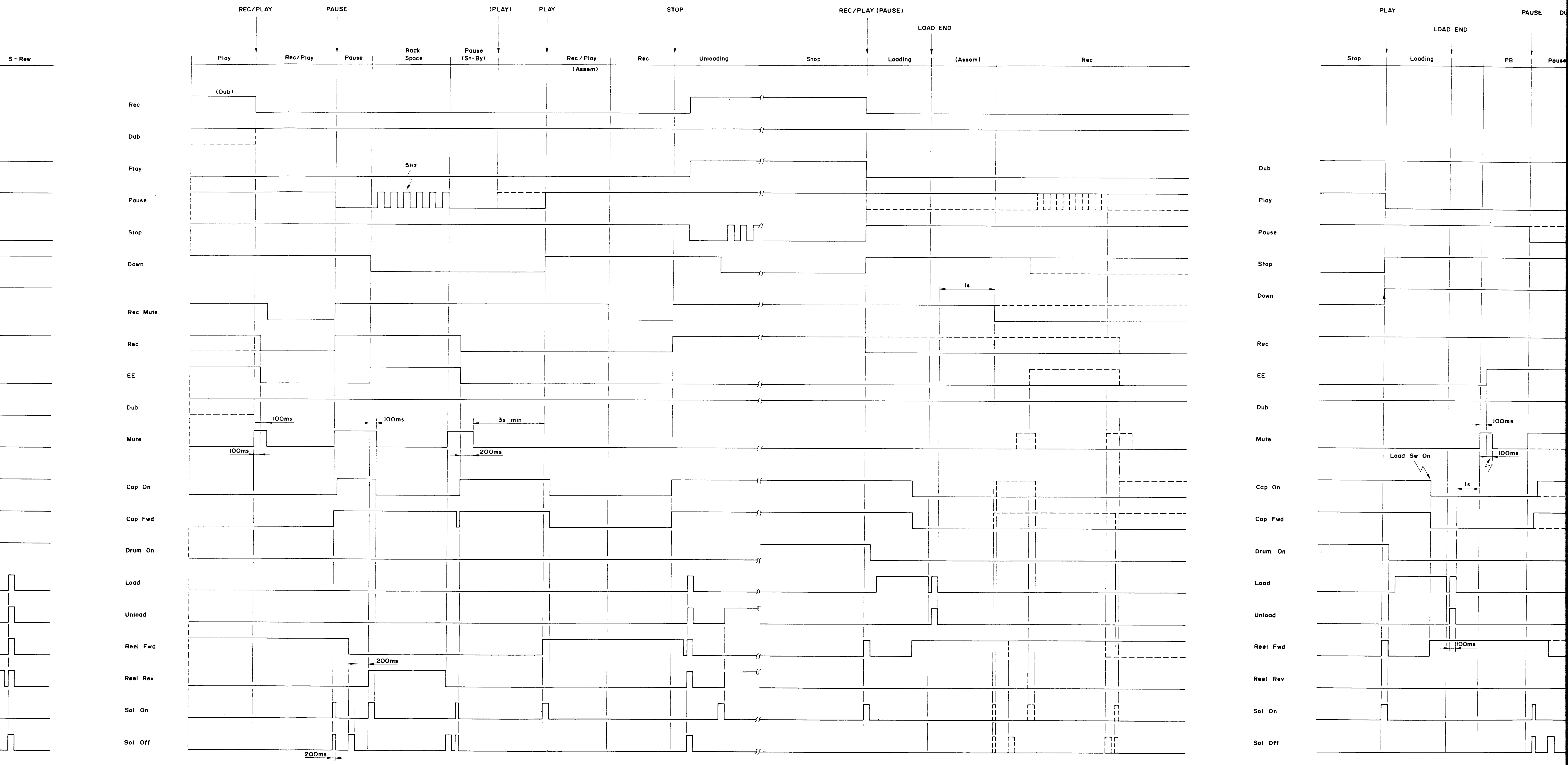
6.8 MECHANISM CONTROL TIMING CHART

– POWER ON, FF, REW & PB MODE –

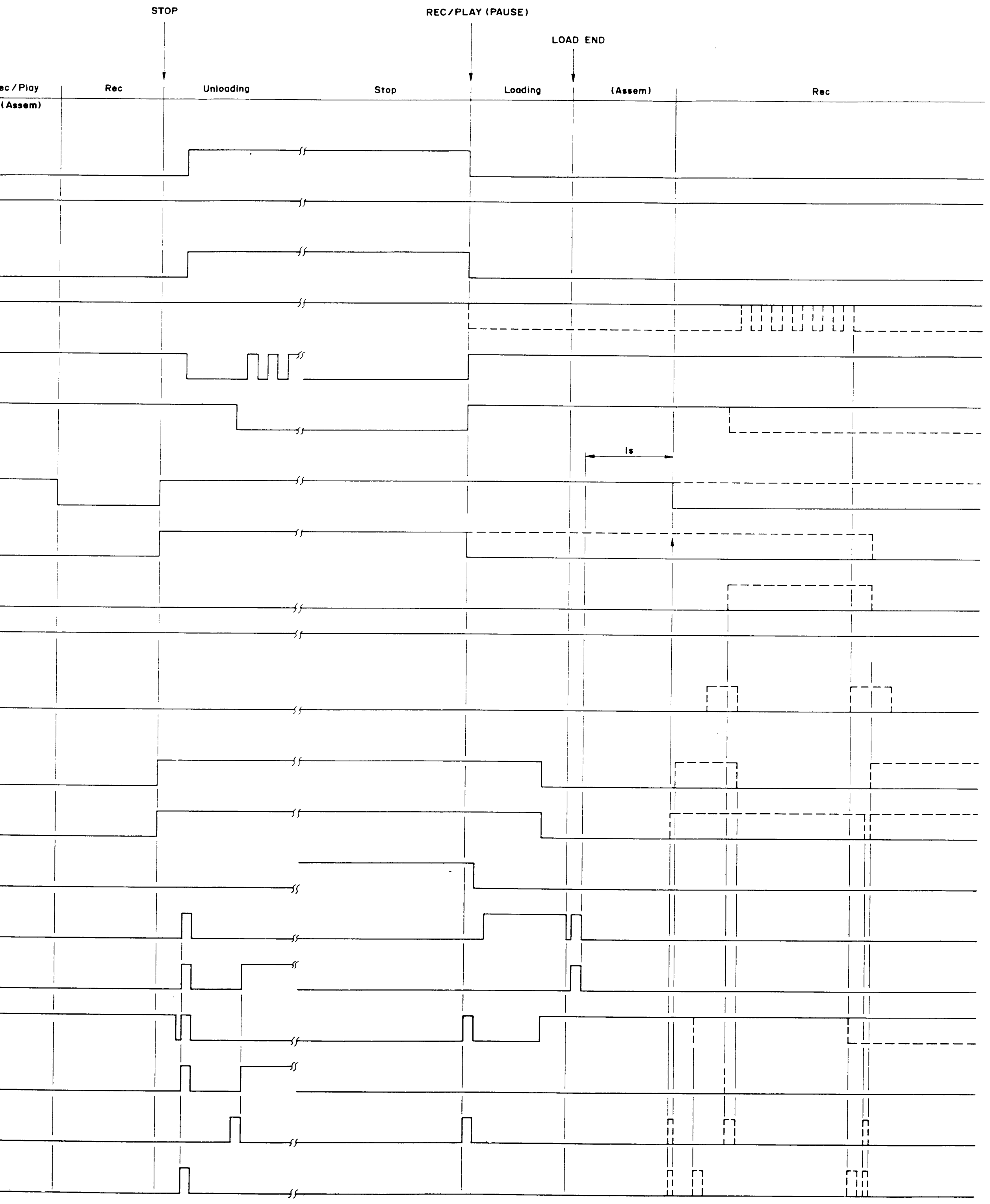

POWER ON
CASS. ON
FF
STOP
REW
PLAY (PAUSE)
LOAD END
PAUSE
PLAY
S-FF
S-FF OFF
S-REW
S-REW OFF
STOP
UNLOAD SW ON
Stop
S-Rew
Stop
FF
Stop
S-Rew
Stop
Rew
Loading
Pause
Play
Pause
S-FF
Pause
S-Rew
Pause
Play
Unloading
Stop
S-Rew
Play
Pause
Stop
FF
Rew
Down
EE
Mute
Search
Cap On
Cap Fwd
Drum On
Load
Unload
Reel Fwd
Reel Rev
Sol On
Sol Off
5Hz
EE
PB
100ms
100ms
100ms
100ms
100ms
100ms
LOAD SW ON
120ms
1 sec
100ms
500ms
20us
100ms
100ms
100ms
40ms
40ms
120ms
500ms
500ms


REC/PLAY
PAUSE
Play
Rec/Play
Pause
(Dub)
Rec
Dub
Play
Pause
Stop
Down
Rec Mute
Rec
EE
Dub
Mute
Cap On
Cap Fwd
Drum On
Load
Unload
Reel Fwd
Reel Rev
Sol On
Sol Off
100ms
100ms
200ms

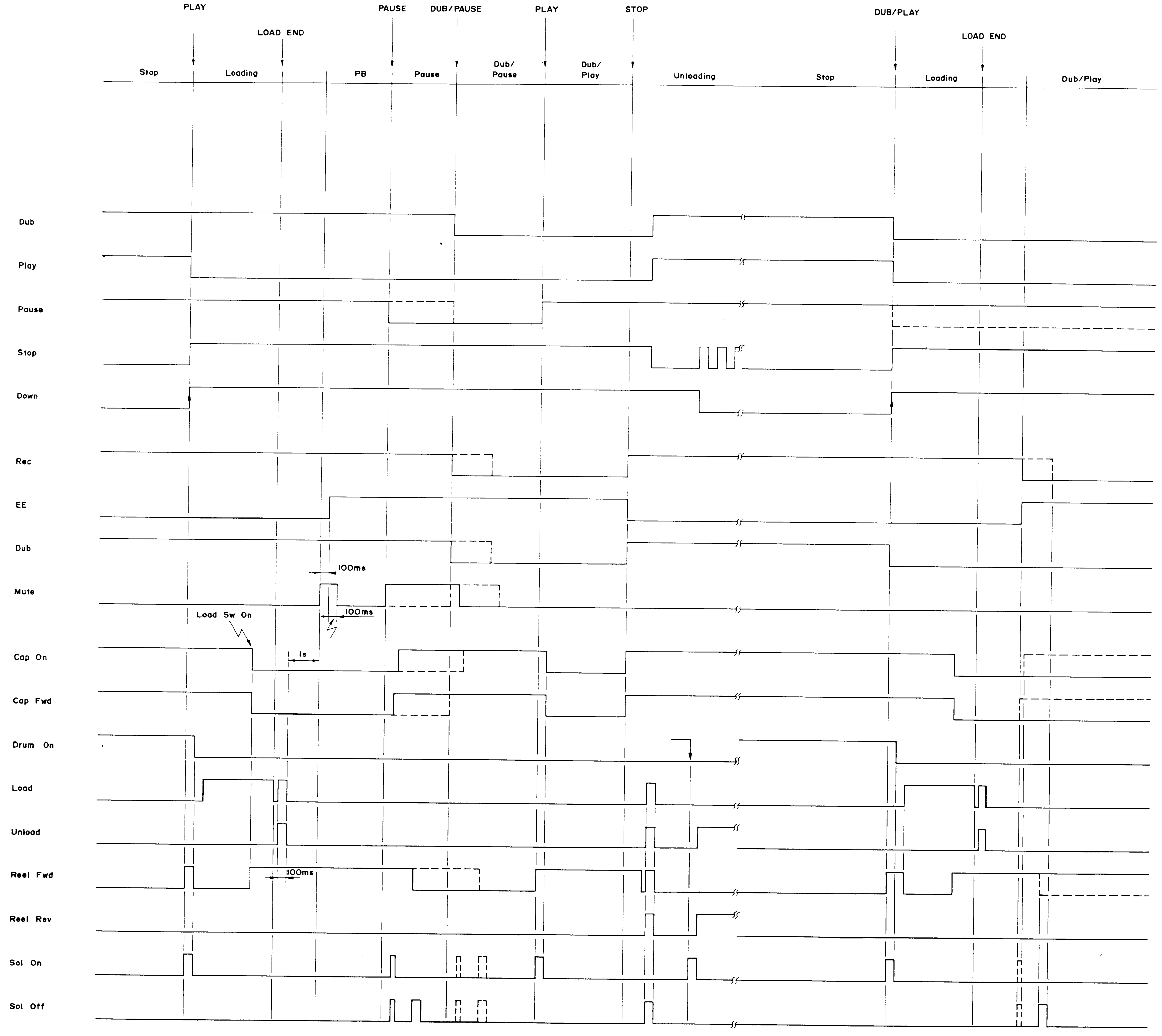
– RECORD MODE –


REC/PLAY
PAUSE
(PLAY)
PLAY
STOP
REC/PLAY (PAUSE)
LOAD END
S-Rew
Play
Rec/Play
Pause
Back Space
Pause (St-By)
Rec/Play (Assem)
Rec
Unloading
Stop
Loading
(Assem)
Rec
(Dub)
Rec
Dub
Play
Pause
Stop
Down
Rec Mute
Rec
EE
Dub
Mute
Cap On
Cap Fwd
Drum On
Load
Unload
Reel Fwd
Reel Rev
Sol On
Sol Off
5Hz
100ms
100ms
100ms
3s min
200ms
200ms
200ms
1s
PLAY
PAUSE
LOAD END
Stop
Loading
PB
Pause
Dub
Play
Pause
Stop
Down
Rec
EE
Dub
Mute
Load Sw On
100ms
100ms
1s
Cap On
Cap Fwd
Drum On
Load
Unload
Reel Fwd
100ms
Reel Rev
Sol On
Sol Off

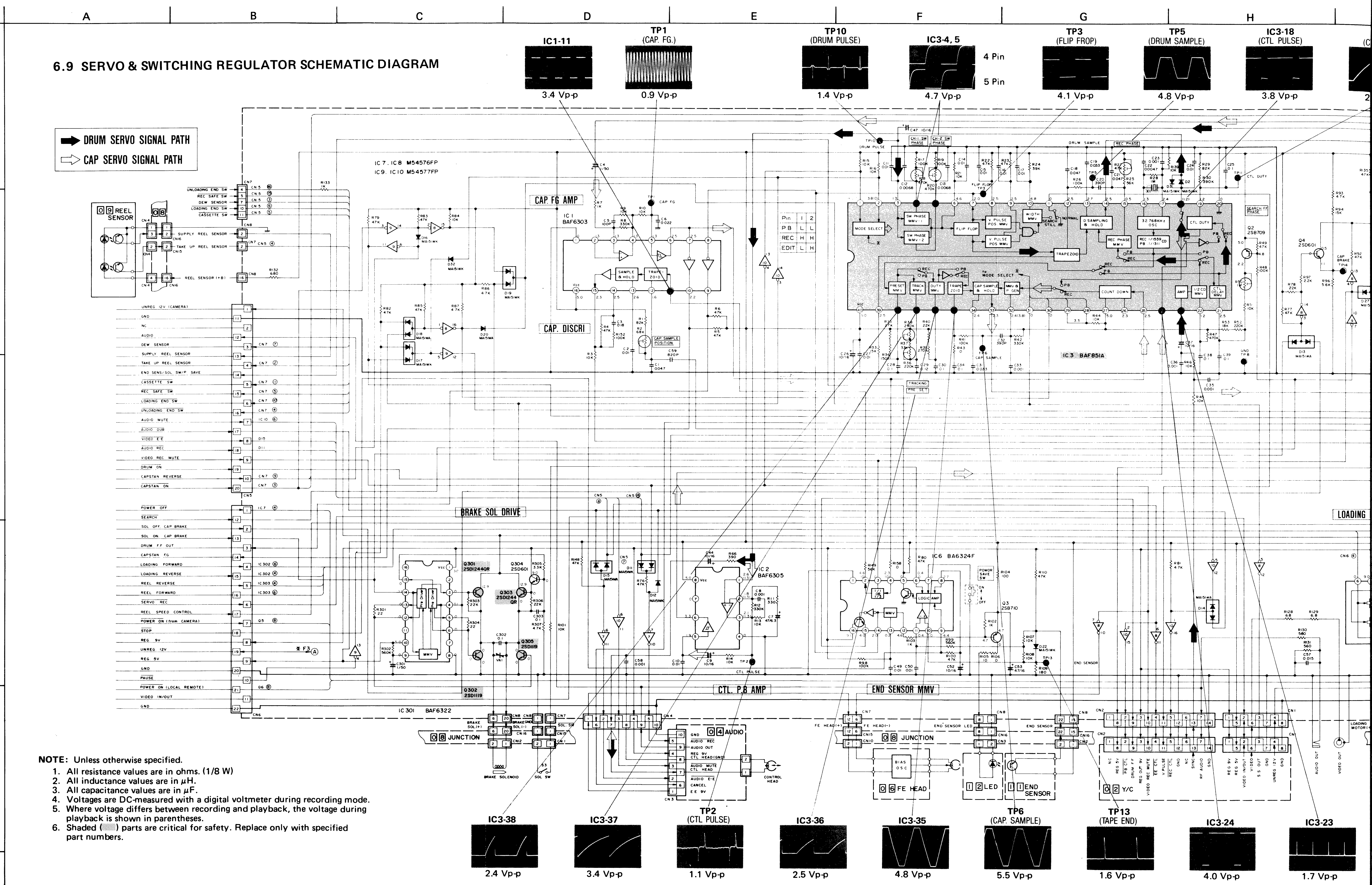
– RECORD MODE –


STOP
REC/PLAY (PAUSE)
LOAD END
ec/Play
(Assem)
Rec
Unloading
Stop
Loading
(Assem)
Rec
1s

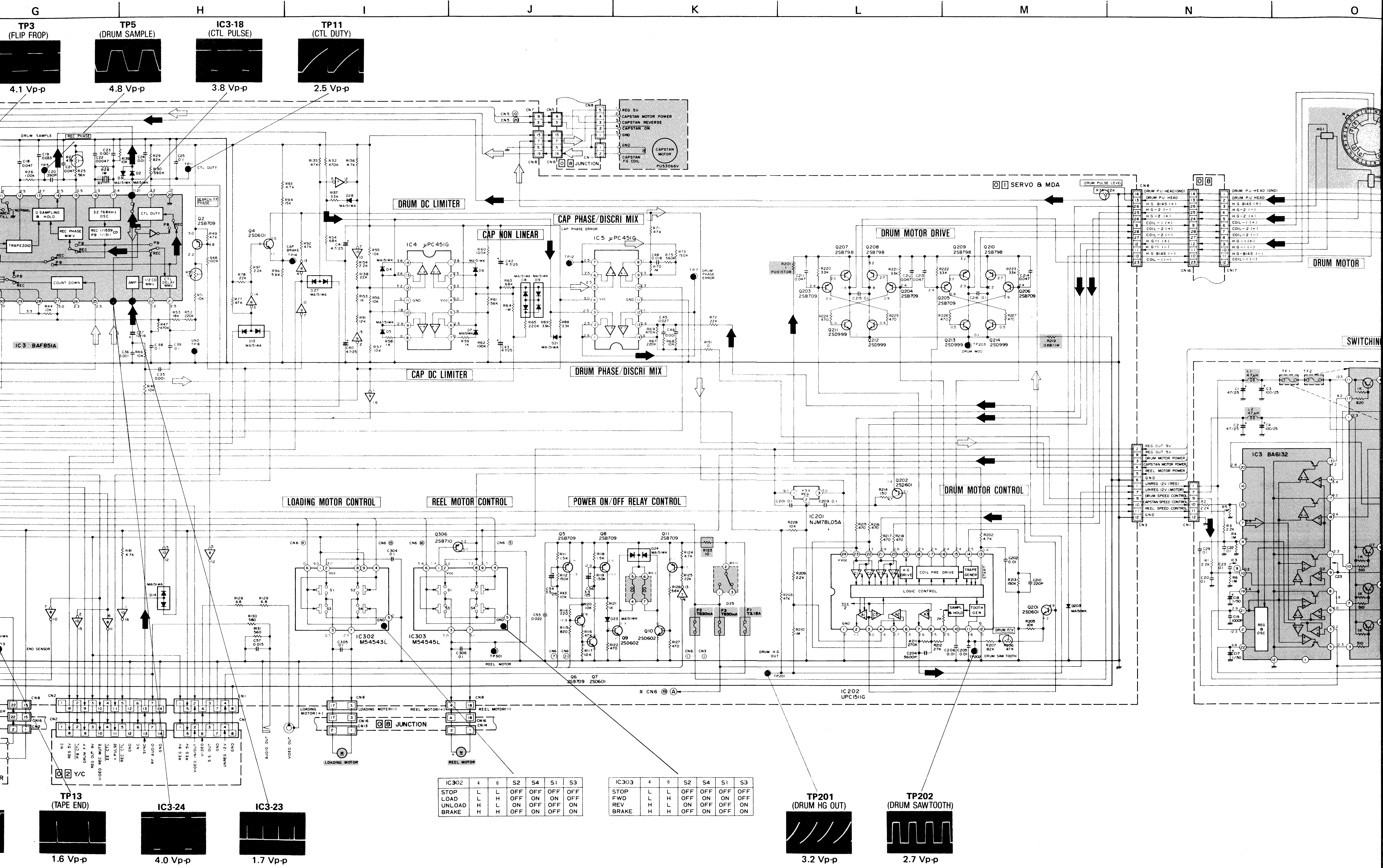
– AUDIO DUB MODE –


PLAY
LOAD END
PAUSE
DUB/PAUSE
PLAY
STOP
DUB/PLAY
LOAD END
Stop
Loading
PB
Pause
Dub/
Pause
Dub/
Play
Unloading
Stop
Loading
Dub/Play
Dub
Play
Pause
Stop
Down
Rec
EE
Dub
Mute
100ms
100ms
Load Sw On
1s
Cap On
Cap Fwd
Drum On
Load
Unload
Reel Fwd
100ms
Reel Rev
Sol On
Sol Off

6.9 SERVO & SWITCHING REGULATOR SCHEMATIC DIAGRAM

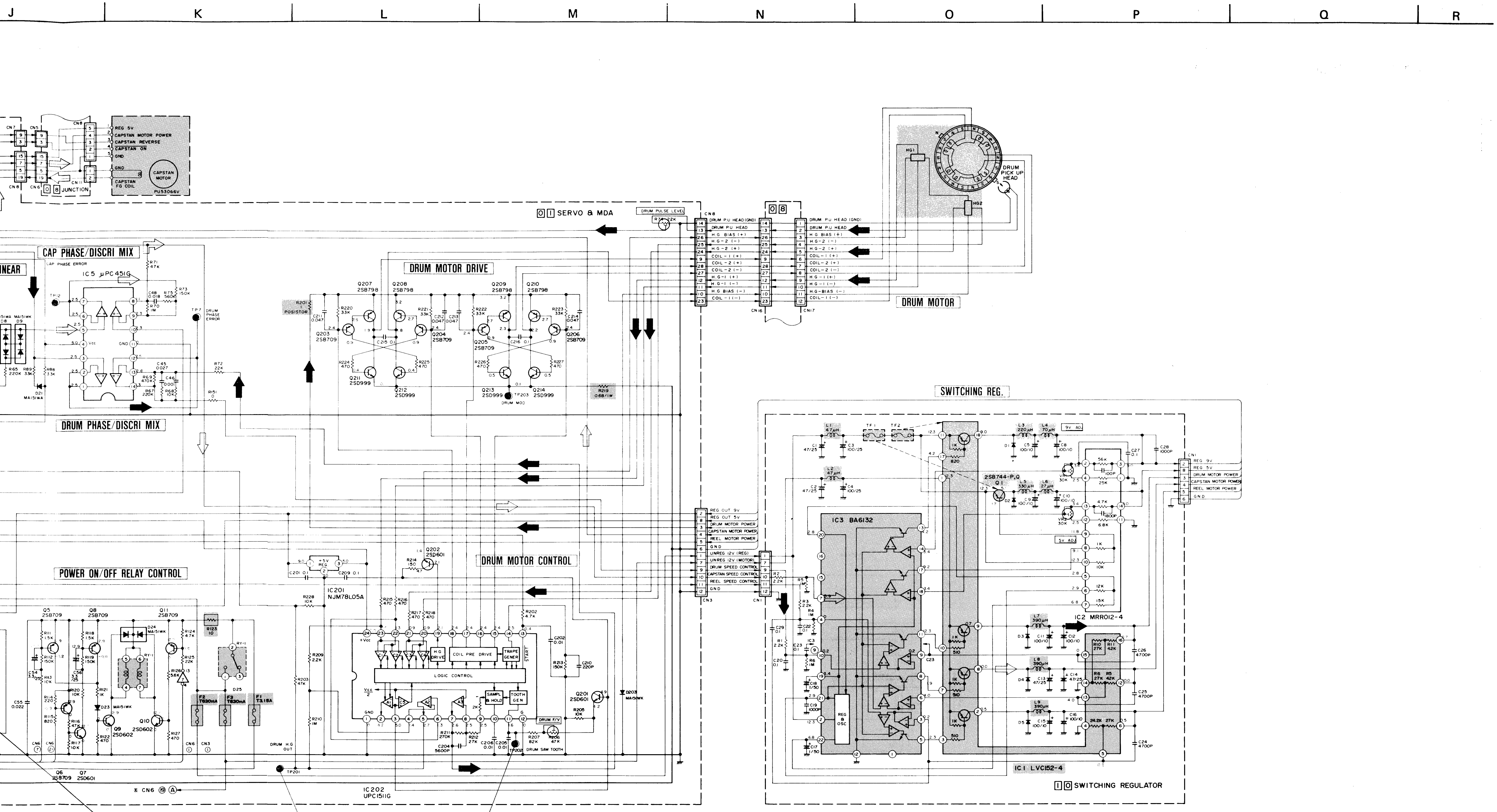

A
B
C
D
E
F
G
H
1
2
3
4
5
6
IC1-11
3.4 Vp-p
TP1
(CAP. FG.)
0.9 Vp-p
TP10
(DRUM PULSE)
1.4 Vp-p
IC3-4, 5
4 Pin
5 Pin
4.7 Vp-p
TP3
(FLIP FROP)
4.1 Vp-p
TP5
(DRUM SAMPLE)
4.8 Vp-p
IC3-18
(CTL PULSE)
3.8 Vp-p
DRUM SERVO SIGNAL PATH
CAP SERVO SIGNAL PATH
09 REEL SENSOR
IC7, IC8 M54576FP
IC9, IC10 M54577FP
CAP FG AMP
IC1 BAF6303
CAP. DISCRI
SAMPLE & HOLD
TRAPEZOID
CAP SAMPLE POSITION
MODE SELECT
SW PHASE MMV-1
SW PHASE MMV-2
FLIP FLOP
V. PULSE POS MMV
WIDTH MMV
D SAMPLING & HOLD
32.768KHz OSC
REC PHASE MMV
REC 1/1539 PB 1/1311 CD
CTL DUTY
SEARCH FF PHASE
PRESET MMV
TRACK MMV
DUTY MMV
CAP SAMPLE & HOLD
MMV & P.GEN
COUNT DOWN
AMP
1/2 CD MMV
CTL DELAY MMV
IC3 BAF851A
TRACKING PRE SET
Q2 2SB709
Q4 2SD601
Pin 1 2
PB L H
REC H H
EDIT L L
UNLOADING END SW
REC SAFE SW
DEW SENSOR
LOADING END SW
CASSETTE SW
SUPPLY REEL SENSOR
TAKE UP REEL SENSOR
REEL SENSOR (+B)
UNREG 12V (CAMERA)
GND
NC
AUDIO
DEW SENSOR
SUPPLY REEL SENSOR
TAKE UP REEL SENSOR
END SENS/SOL SW/P SAVE
CASSETTE SW
REC SAFE SW
LOADING END SW
UNLOADING END SW
AUDIO MUTE
AUDIO DUB
VIDEO E-E
AUDIO REC
VIDEO REC MUTE
DRUM ON
CAPSTAN REVERSE
CAPSTAN ON
POWER OFF
SEARCH
SOL OFF CAP BRAKE
SOL ON CAP BRAKE
DRUM FF OUT
CAPSTAN FG
LOADING FORWARD
LOADING REVERSE
REEL REVERSE
REEL FORWARD
SERVO REC
REEL SPEED CONTROL
POWER ON (from CAMERA)
STOP
REG 9V
UNREG 12V
REG 5V
GND
PAUSE
POWER ON (LOCAL REMOTE)
VIDEO IN/OUT
GND
BRAKE SOL DRIVE
Q301 2SD1244QR
Q304 2SD601
Q303 2SD1244QR
Q305 2SD1119
Q302 2SD1119
IC301 BAF6322
MMV
IC2 BAF6305
CTL. P.B AMP
IC6 BA6324F
LOGIC AMP
POWOR SAVE SW
Q3 2SB710
END SENSOR MMV
END SENSOR
LOADING
08 JUNCTION
BRAKE SOLENOID
SOL SW
04 AUDIO
CONTROL HEAD
FE HEAD(+)
FE HEAD(-)
08 JUNCTION
BIAS OSC
06 FE HEAD
12 LED
11 END SENSOR
02 Y/C
IC3-38
2.4 Vp-p
IC3-37
3.4 Vp-p
TP2
(CTL PULSE)
1.1 Vp-p
IC3-36
2.5 Vp-p
IC3-35
4.8 Vp-p
TP6
(CAP. SAMPLE)
5.5 Vp-p
TP13
(TAPE END)
1.6 Vp-p
IC3-24
4.0 Vp-p
IC3-23
1.7 Vp-p

NOTE: Unless otherwise specified.
1. All resistance values are in ohms. (1/8 W)
2. All inductance values are in μH.
3. All capacitance values are in μF.
4. Voltages are DC-measured with a digital voltmeter during recording mode.
5. Where voltage differs between recording and playback, the voltage during playback is shown in parentheses.
6. Shaded (▨) parts are critical for safety. Replace only with specified part numbers.


G
H
I
J
K
L
M
N
O
TP3
(FLIP FROP)
4.1 Vp-p
TP5
(DRUM SAMPLE)
4.8 Vp-p
IC3-18
(CTL PULSE)
3.8 Vp-p
TP11
(CTL DUTY)
2.5 Vp-p
DRUM SAMPLE
REC PHASE
IC3 BA F851A
D.SAMPLING & HOLD
32.768KHz OSC
CTL DUTY
TRAPEZOID
REC PHASE MMV
COUNT DOWN
AMP
1/2 CD MMV
CTL DELAY MMV
SEARCH FF PHASE
Q2 2SB709
Q4 2SD601
DRUM DC LIMITER
CAP PHASE/DISCRI MIX
CAP NON LINEAR
IC4 μPC451G
IC5 μPC451G
CAP DC LIMITER
DRUM PHASE/DISCRI MIX
DRUM PHASE ERROR
CN5
CN7
CN8
CN6
CN11
08 JUNCTION
REG 5V
CAPSTAN MOTOR POWER
CAPSTAN REVERSE
CAPSTAN ON
GND
CAPSTAN MOTOR
CAPSTAN FG COIL
PU53066V
01 SERVO & MDA
DRUM PULSE LEVEL
DRUM MOTOR DRIVE
Q207 2SB798
Q208 2SB798
Q209 2SB798
Q210 2SB798
Q203 2SB709
Q204 2SB709
Q205 2SB709
Q206 2SB709
Q211 2SD999
Q212 2SD999
Q213 2SD999
Q214 2SD999
R201 POSISTOR
R219 0.68/1W
DRUM P.U HEAD (GND)
DRUM P.U HEAD
H.G BIAS (+)
H.G-2 (-)
H.G-2 (+)
COIL-1 (+)
COIL-2 (+)
COIL-2 (-)
H.G-1 (+)
H.G-1 (-)
COIL-1 (-)
H.G-BIAS (-)
CN16
CN17
DRUM MOTOR
MG1
SWITCHING
REG OUT 9V
REG OUT 5V
DRUM MOTOR POWER
CAPSTAN MOTOR POWER
REEL MOTOR POWER
UNREG 12V (REG)
UNREG 12V (MOTOR)
DRUM SPEED CONTROL
CAPSTAN SPEED CONTROL
REEL SPEED CONTROL
IC3 BA6132
REG & OSC
LOADING MOTOR CONTROL
REEL MOTOR CONTROL
POWER ON/OFF RELAY CONTROL
DRUM MOTOR CONTROL
IC201 NJM78L05A
IC202 UPC1511G
HG DRIVE
COIL PRE DRIVE
TRAPE GENER
LOGIC CONTROL
SAMPL & HOLD
TOOTH GEN
DRUM F/V
DRUM SAW TOOTH
Q202 2SD601
Q201 2SD601
IC302 M54543L
IC303 M54545L
Q306 2SB710
Q5 2SB709
Q8 2SB709
Q11 2SB709
Q9 2SD602
Q10 2SD602
Q6 2SB709
Q7 2SD601
F2 T630mA
F3 T630mA
F1 T3.15A
RY-1
REEL MOTOR
END SENSOR
DRUM HG OUT
LOADING MOTOR
02 Y/C
08 JUNCTION
NC
REG 5V
PB CTL
DRUM FF
VIDEO REC MUTE
V PULSE
REC CTL
GND
SYNC
RF AUDIO
REG 9V
VIDEO IN/OUT
S.S OUT
UNREG 12V
AUDIO OUT
VIDEO OUT
TP13
(TAPE END)
1.6 Vp-p
IC3-24
4.0 Vp-p
IC3-23
1.7 Vp-p
TP201
(DRUM HG OUT)
3.2 Vp-p
TP202
(DRUM SAWTOOTH)
2.7 Vp-p

IC302	4	6	S2	S4	S1	S3
STOP	L	L	OFF	OFF	OFF	OFF
LOAD	L	H	OFF	ON	ON	OFF
UNLOAD	H	L	ON	OFF	OFF	ON
BRAKE	H	H	OFF	ON	OFF	ON

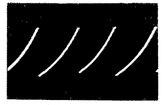
IC303	4	6	S2	S4	S1	S3
STOP	L	L	OFF	OFF	OFF	OFF
FWD	L	H	OFF	ON	ON	OFF
REV	H	L	ON	OFF	OFF	ON
BRAKE	H	H	OFF	ON	OFF	ON


J
K
L
M
N
O
P
Q
R
CN7
CN5
CN8
CN6
CN11
08 JUNCTION
REG 5V
CAPSTAN MOTOR POWER
CAPSTAN REVERSE
CAPSTAN ON
GND
CAPSTAN FG COIL
CAPSTAN MOTOR
PU53066V
01 SERVO & MDA
CAP PHASE/DISCRI MIX
IC5 μPC451G
DRUM PHASE/DISCRI MIX
DRUM MOTOR DRIVE
R201 POSISTOR
DRUM MOTOR CONTROL
POWER ON/OFF RELAY CONTROL
IC201 NJM78L05A
IC202 UPC1511G
COIL PRE DRIVE
H.G DRIVE
TRAPE GENER
LOGIC CONTROL
SAMPL & HOLD
TOOTH GEN
DRUM F/V
DRUM SAW TOOTH
DRUM H.G OUT
TP201
TP202
DRUM PULSE LEVEL
CN8
CN16
CN17
08
DRUM P.U HEAD (GND)
DRUM P.U HEAD
H.G BIAS (+)
H.G-2 (−)
H.G-2 (+)
COIL-1 (+)
COIL-2 (+)
COIL-2 (−)
H.G-1 (+)
H.G-1 (−)
H.G BIAS (−)
COIL-1 (−)
HG1
HG2
DRUM PICK UP HEAD
DRUM MOTOR
REG OUT 9V
REG OUT 5V
DRUM MOTOR POWER
CAPSTAN MOTOR POWER
REEL MOTOR POWER
GND
UNREG 12V (REG)
UNREG 12V (MOTOR)
DRUM SPEED CONTROL
CAPSTAN SPEED CONTROL
REEL SPEED CONTROL
CN3
CN1
SWITCHING REG.
IC3 BA6132
REG & OSC
IC2 MRR012-4
IC1 LVC152-4
2SB744-P,Q
9V ADJ
5V ADJ
REG 9V
REG 5V
10 SWITCHING REGULATOR
※ CN6 ⑲ Ⓐ
F1 T3.15A
F2 T630mA
F3 T630mA
RY-1
D25

S4	S1	S3
OFF	OFF	OFF
ON	ON	OFF
OFF	OFF	ON
ON	OFF	ON

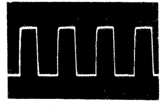
IC303	4	6	S2	S4	S1	S3
STOP	L	L	OFF	OFF	OFF	OFF
FWD	L	H	OFF	ON	ON	OFF
REV	H	L	ON	OFF	OFF	ON
BRAKE	H	H	OFF	ON	OFF	ON

TP201
(DRUM HG OUT)



3.2 Vp-p

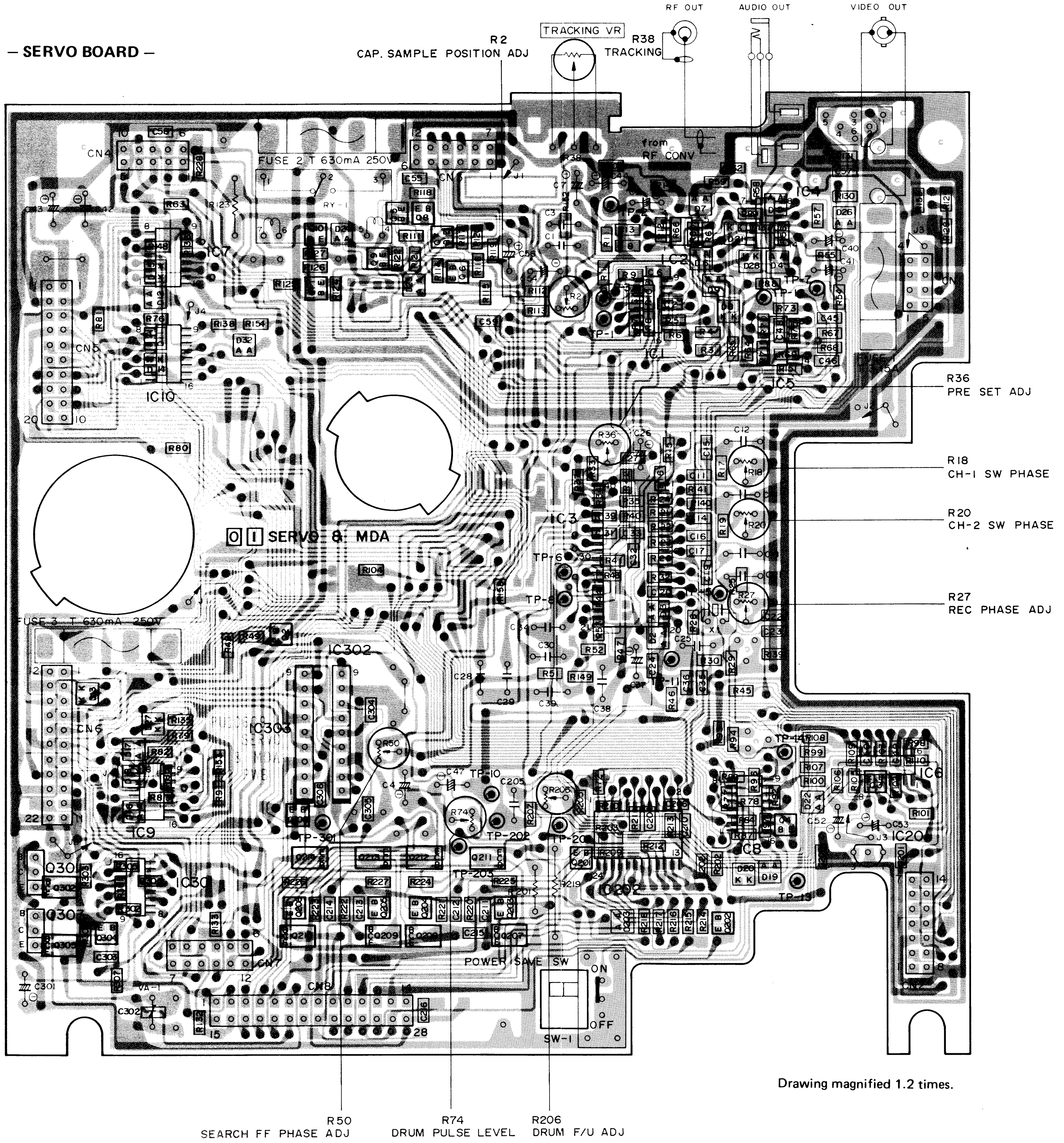
TP202
(DRUM SAWTOOTH)



2.7 Vp-p

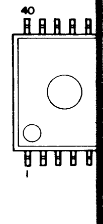
6.10 SERVO & SWITCHING REGULATOR CIRCUIT BOARD

— SERVO BOARD —

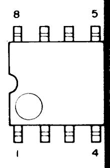

R2
CAP. SAMPLE POSITION ADJ
TRACKING VR
R38
TRACKING
RF OUT
AUDIO OUT
VIDEO OUT
from RF CONV
R36
PRE SET ADJ
R18
CH-1 SW PHASE
R20
CH-2 SW PHASE
R27
REC PHASE ADJ
R50
SEARCH FF PHASE ADJ
R74
DRUM PULSE LEVEL
R206
DRUM F/U ADJ
SERVO & MDA
FUSE 2 T 630mA 250V
FUSE 3 T 630mA 250V
POWER SAVE SW
SW-1
ON
OFF
CN4
CN5
CN6
CN7
CN8
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC20
IC202
IC301
IC302
IC303
TP-1
TP-6
TP-8
TP-10
TP-13
TP-20
TP-202
TP-203
TP-301

Drawing magnified 1.2 times.

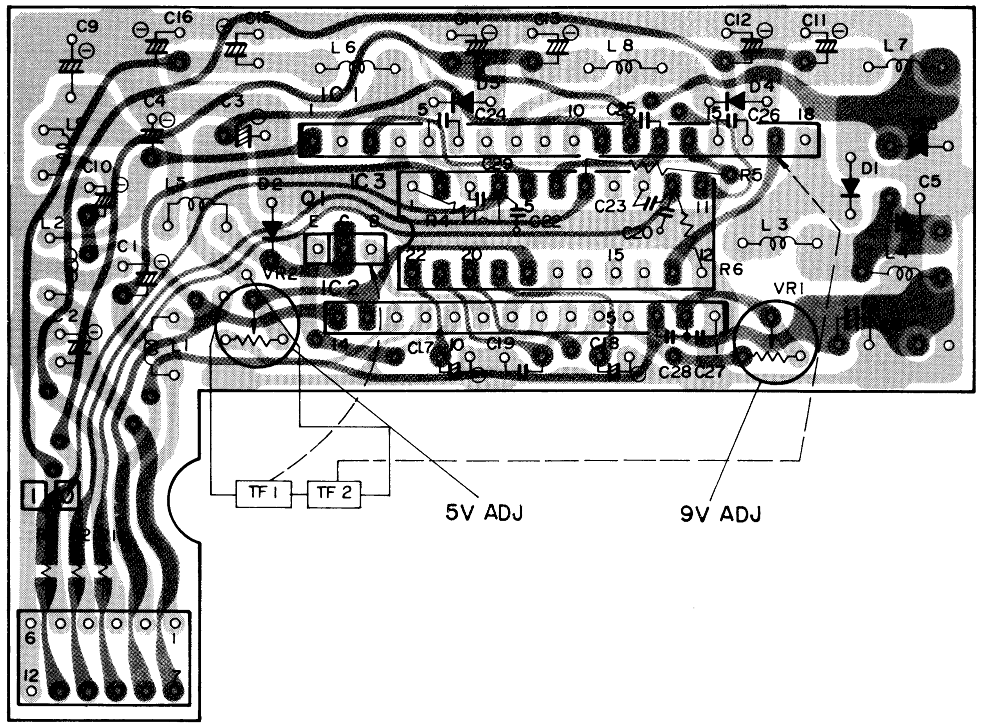
BAF851



BAF6305

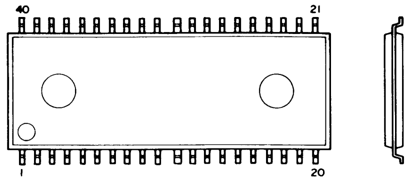


– SWITCHING REGULATOR BOARD –

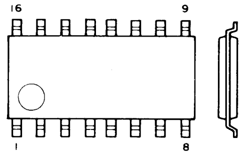

C9
C16
C15
C14
C13
C12
C11
L6
L8
L7
D3
D4
IC1
5
C24
10
C25
15
C26
18
C4
C3
C10
C29
R5
D1
C5
L5
D2
Q1
IC3
E
C
B
R4
C22
C23
C20
L3
L2
C1
22
20
15
12
R6
VR2
IC2
VR1
14
C17
10
C19
C18
5
C28
C27
TF1
TF2
5V ADJ
9V ADJ
6
1
12
7

Drawing magnified 1.5 times.

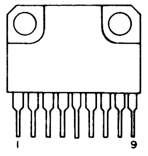
BAF851A



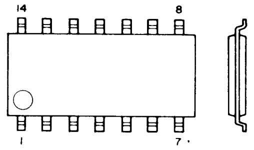
BA6322F
BA6324F
BAF6303



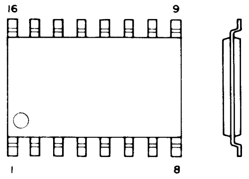
M54543L
M54545L



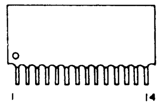
UPC451G



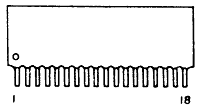
M54576FP
M54577FP



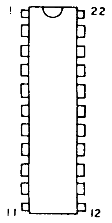
MMR-011-4



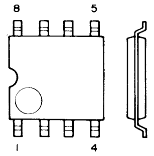
LVC-152-4



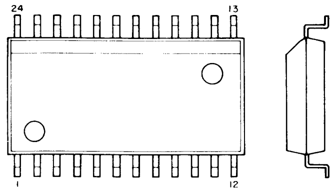
BA6132



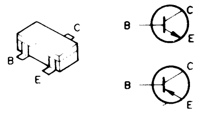
BAF6305



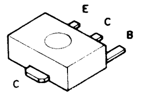
UPC1151G



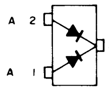
2SB709 (Chip)
2SB710 (")
2SD601 (Chip)
2SD602 (")



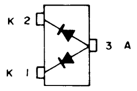
2SB798 (Chip) [POWER]
2SC2873 (") [POWER]
2SD999 (") [POWER]
2SD1119 (") [POWER]

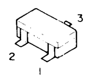


MA151WK (Chip)

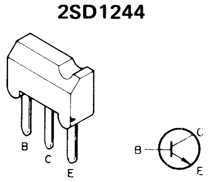


MA151WA (Chip)

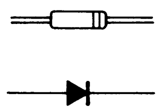




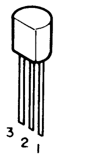
2SD1244



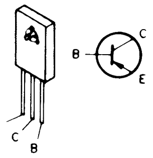
ERB81-004U15A
ERA81-004U16A



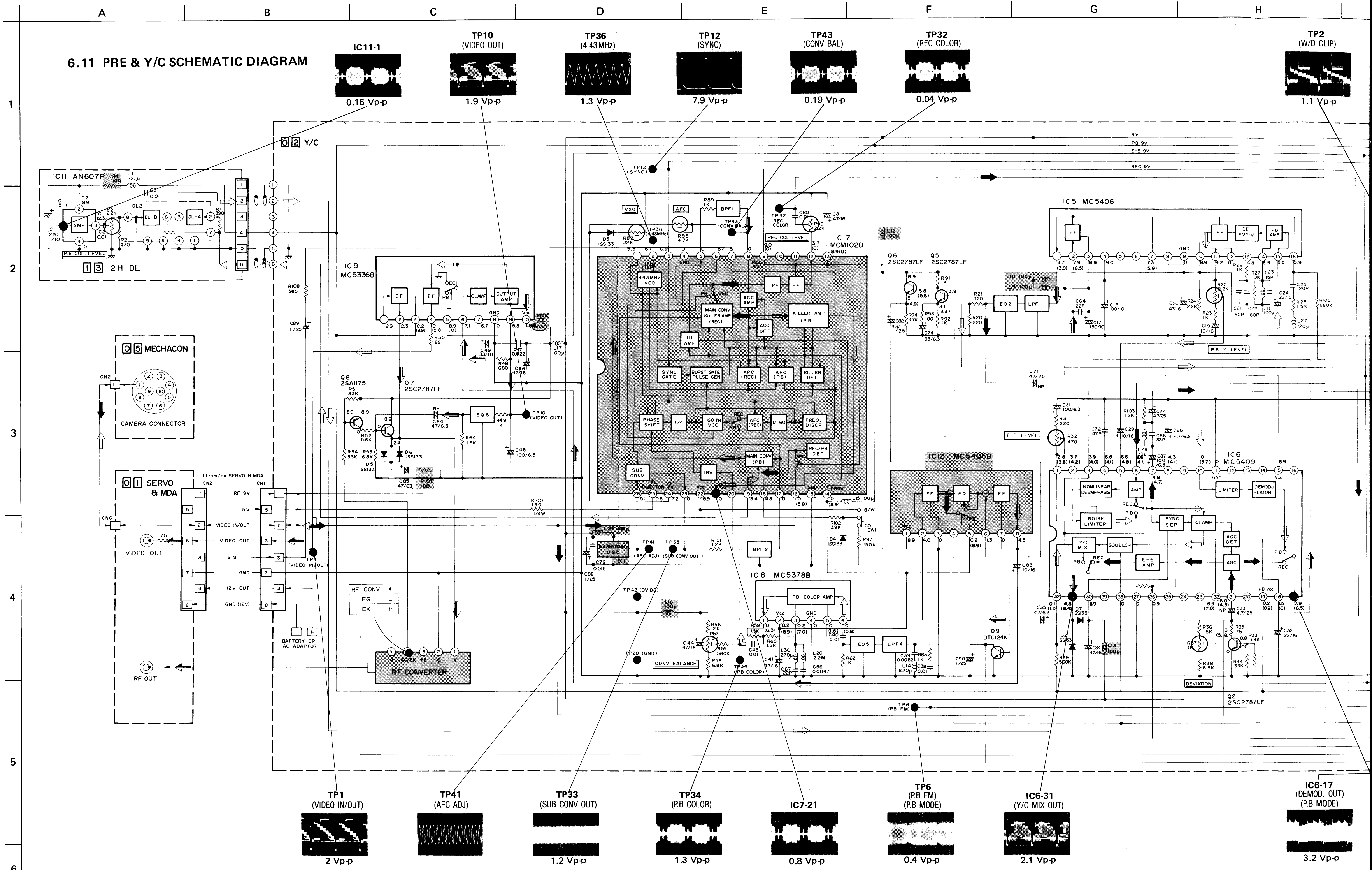
NJM78L05A



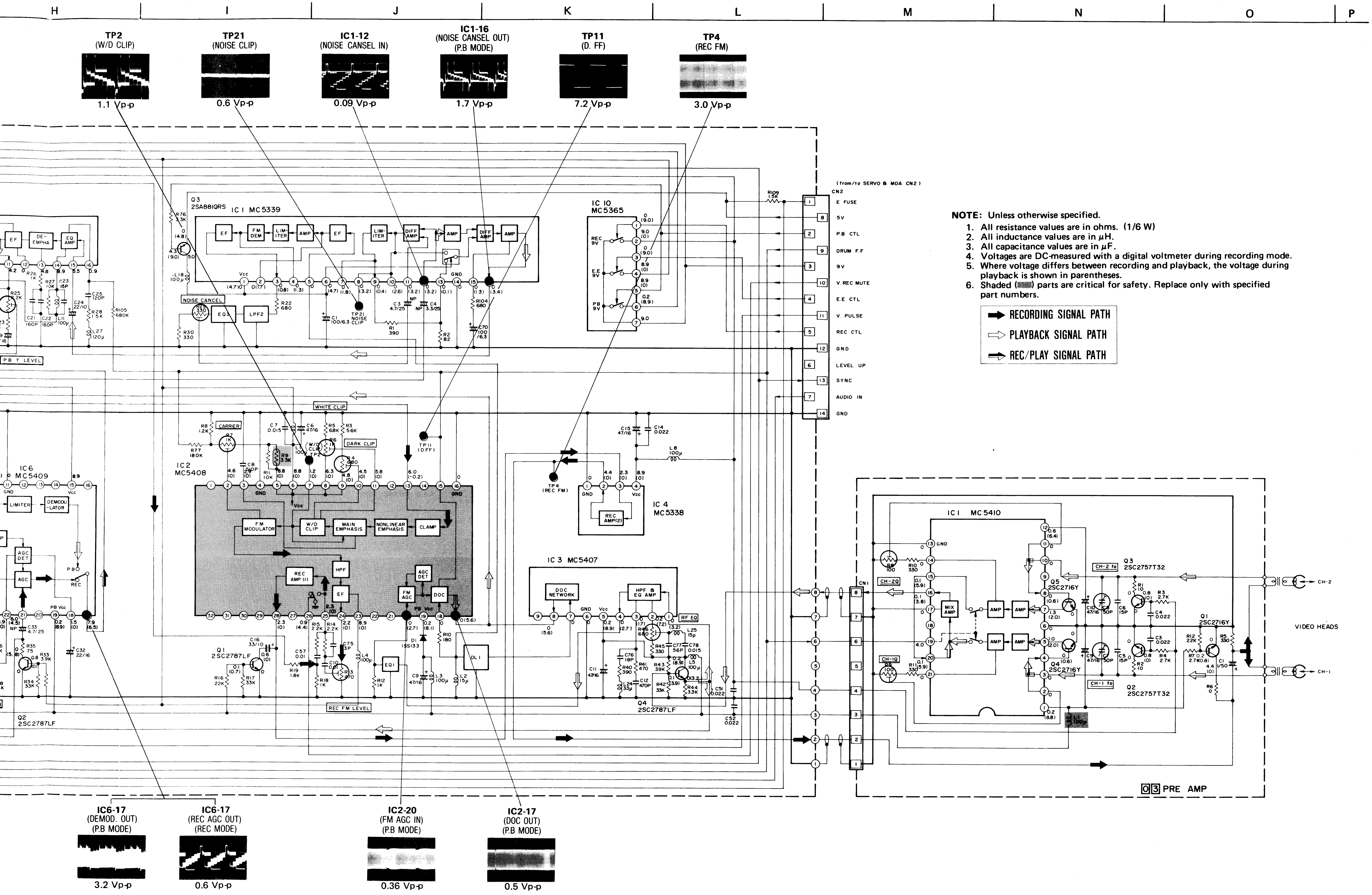
2SB744



6.11 PRE & Y/C SCHEMATIC DIAGRAM



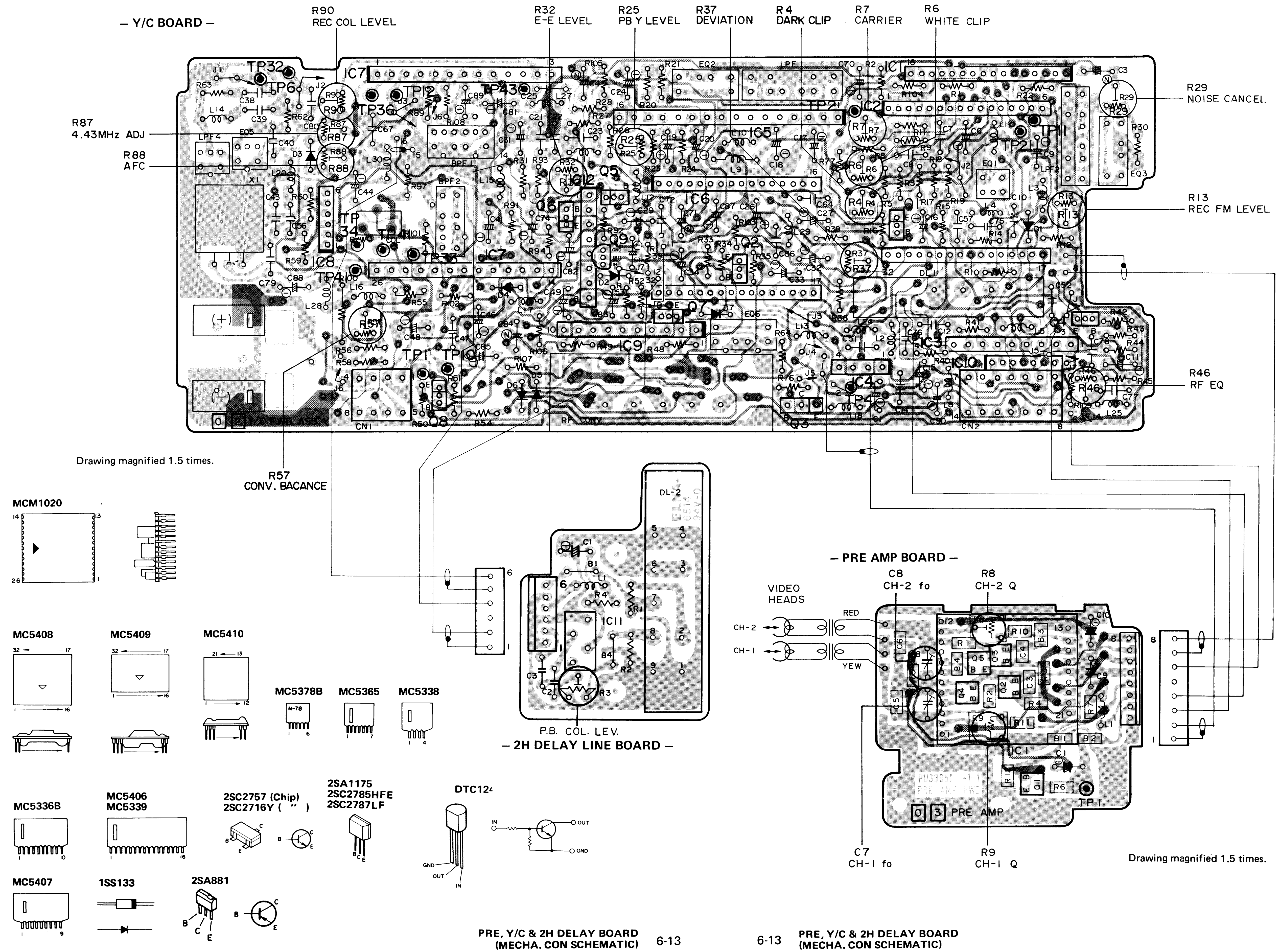
A
B
C
D
E
F
G
H
1
2
3
4
5
6
IC11-1
0.16 Vp-p
TP10
(VIDEO OUT)
1.9 Vp-p
TP36
(4.43MHz)
1.3 Vp-p
TP12
(SYNC)
7.9 Vp-p
TP43
(CONV BAL)
0.19 Vp-p
TP32
(REC COLOR)
0.04 Vp-p
TP2
(W/D CLIP)
1.1 Vp-p
02 Y/C
IC11 AN607P
13 2H DL
P.B COL. LEVEL
DL-B
DL-A
AMP
IC9
MC5336B
EF
CLAMP
OUTPUT AMP
Q8 2SA1175
Q7 2SC2787LF
EQ6
TP10 (VIDEO OUT)
05 MECHACON
CAMERA CONNECTOR
01 SERVO & MDA
(from/to SERVO & MDA)
RF 9V
5V
VIDEO IN/OUT
VIDEO OUT
S.S
GND
12V OUT
GND (12V)
VIDEO OUT
RF OUT
BATTERY OR AC ADAPTOR
TP1 (VIDEO IN/OUT)
RF CONV
EG
EK
RF CONVERTER
A
EG/EK
+B
G
V
IC 7
MCM1020
VXO
AFC
TP12 (SYNC)
TP36 (4.43MHz)
TP43 (CONV BAL)
TP32 REC COLOR
REC COL LEVEL
BPF1
4.43MHz VCO
MAIN CONV KILLER AMP (REC)
ACC AMP
ACC DET
LPF
EF
KILLER AMP (PB)
ID AMP
SYNC GATE
BURST GATE PULSE GEN
APC (REC)
APC (PB)
KILLER DET
PHASE SHIFT
1/4
160 fH VCO
AFC (REC)
1/160
FREQ. DISCR
SUB CONV.
INV
MAIN CONV (PB)
REC/PB DET
FL INJECTOR
V2 TV
PB9V
4.43357MHz OSC
X1
TP41 (AFC ADJ)
TP33 (SUB CONV OUT)
TP42 (9V DC)
TP20 (GND)
CONV. BALANCE
TP34 (PB COLOR)
BPF 2
B/W
COL SW1
IC 8 MC5378B
PB COLOR AMP
EQ5
LPF4
Q9 DTC124N
TP6 (PB FM)
Q6 2SC2787LF
Q5 2SC2787LF
EQ2
LPF1
IC12 MC5405B
EF
EQ
IC5 MC5406
DE-EMPHA
EQ AMP
PB Y LEVEL
9V
PB 9V
E-E 9V
REC 9V
E-E LEVEL
IC6
MC5409
NONLINEAR DEEMPHASIS
AMP
LIMITER
DEMODU-LATOR
NOISE LIMITER
SYNC SEP
CLAMP
Y/C MIX
SQUELCH
E-E AMP
AGC DET
AGC
DEVIATION
Q2 2SC2787LF
TP1
(VIDEO IN/OUT)
2 Vp-p
TP41
(AFC ADJ)
TP33
(SUB CONV OUT)
1.2 Vp-p
TP34
(P.B COLOR)
1.3 Vp-p
IC7-21
0.8 Vp-p
TP6
(P.B FM)
(P.B MODE)
0.4 Vp-p
IC6-31
(Y/C MIX OUT)
2.1 Vp-p
IC6-17
(DEMOD. OUT)
(P.B MODE)
3.2 Vp-p


H
I
J
K
L
M
N
O
P
TP2
(W/D CLIP)
1.1 Vp-p
TP21
(NOISE CLIP)
0.6 Vp-p
IC1-12
(NOISE CANSEL IN)
0.09 Vp-p
IC1-16
(NOISE CANSEL OUT)
(P.B MODE)
1.7 Vp-p
TP11
(D. FF)
7.2 Vp-p
TP4
(REC FM)
3.0 Vp-p
Q3
2SA881QRS
IC1 MC5339
EF
FM DEM
LIM-ITER
AMP
DIFF AMP
NOISE CANCEL
EQ3
LPF2
IC6
MC5409
DE-EMPHA
EQ AMP
LIMITER
DEMODU-LATOR
AGC DET
AGC
PB Y LEVEL
IC10
MC5365
REC 9V
E.E 9V
PB 9V
(from/to SERVO & MDA CN2)
CN2
E FUSE
5V
P.B CTL
DRUM F.F
9V
V.REC MUTE
E.E CTL
V. PULSE
REC CTL
GND
LEVEL UP
SYNC
AUDIO IN
GND
IC2
MC5408
CARRIER
WHITE CLIP
DARK CLIP
W/D CLIP
TP11 (D.FF)
FM MODULATOR
W/D CLIP
MAIN EMPHASIS
NONLINEAR EMPHASIS
CLAMP
REC AMP (1)
HPF
EF
AGC DET
FM AGC
DOC
REC FM LEVEL
EQ1
DL1
Q1
2SC2787LF
Q2
2SC2787LF
TP4 (REC FM)
IC4
MC5338
REC AMP(2)
IC3 MC5407
DOC NETWORK
HPF & EQ AMP
RF EQ
Q4
2SC2787LF
IC1 MC5410
MIX AMP
AMP
CH-2Q
CH-1Q
CH-2 fo
CH-1 fo
Q3
2SC2757T32
Q5
2SC2716Y
Q4
2SC2716Y
Q2
2SC2757T32
Q1
2SC2716Y
CN1
CH-2
CH-1
VIDEO HEADS
03 PRE AMP
IC6-17
(DEMOD. OUT)
(P.B MODE)
3.2 Vp-p
IC6-17
(REC AGC OUT)
(REC MODE)
0.6 Vp-p
IC2-20
(FM AGC IN)
(P.B MODE)
0.36 Vp-p
IC2-17
(DOC OUT)
(P.B MODE)
0.5 Vp-p
RECORDING SIGNAL PATH
PLAYBACK SIGNAL PATH
REC/PLAY SIGNAL PATH

NOTE: Unless otherwise specified.

1. All resistance values are in ohms. (1/6 W)
2. All inductance values are in μH.
3. All capacitance values are in μF.
4. Voltages are DC-measured with a digital voltmeter during recording mode.
5. Where voltage differs between recording and playback, the voltage during playback is shown in parentheses.
6. Shaded (▨) parts are critical for safety. Replace only with specified part numbers.

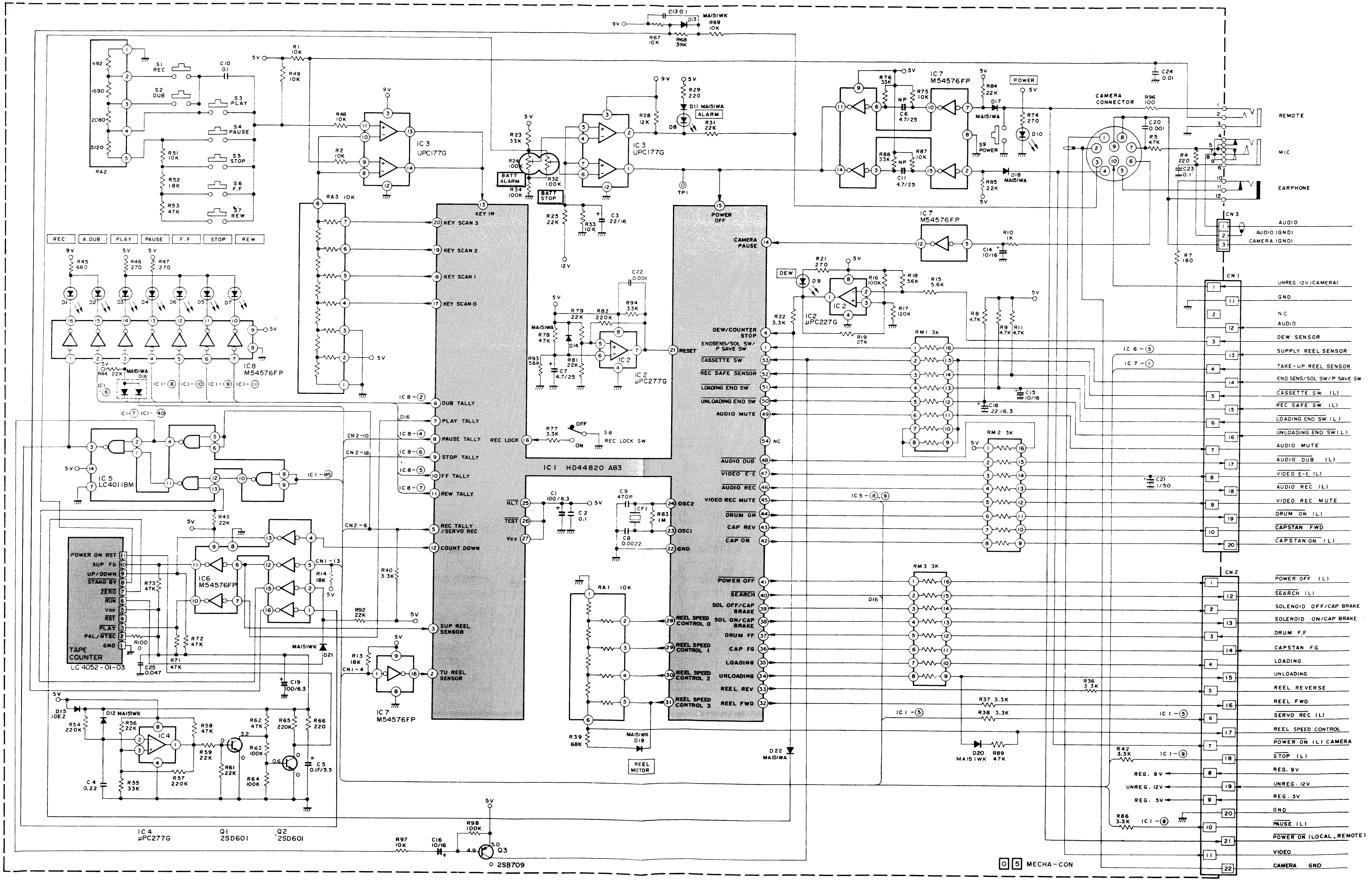
6.12 PRE, Y/C AND 2H DELAY LINE CIRCUIT BOARDS


– Y/C BOARD –
R90 REC COL LEVEL
R32 E-E LEVEL
R25 PB Y LEVEL
R37 DEVIATION
R4 DARK CLIP
R7 CARRIER
R6 WHITE CLIP
R29 NOISE CANCEL.
R87 4.43MHz ADJ
R88 AFC
R13 REC FM LEVEL
R46 RF EQ
R57 CONV. BACANCE
02 Y/C PWB ASS'Y
DL-2
P.B. COL. LEV.
– 2H DELAY LINE BOARD –
– PRE AMP BOARD –
C8 CH-2 fo
R8 CH-2 Q
VIDEO HEADS
RED
YEW
CH-2
CH-1
C7 CH-1 fo
R9 CH-1 Q
PU33951 -1-1 PRE AMP PWB
03 PRE AMP
TP1
MCM1020
MC5408
MC5409
MC5410
MC5378B
MC5365
MC5338
MC5336B
MC5406
MC5339
2SC2757 (Chip)
2SC2716Y (")
2SA1175
2SC2785HFE
2SC2787LF
DTC12
IN
OUT
GND
MC5407
1SS133
2SA881
B C E

Drawing magnified 1.5 times.

Drawing magnified 1.5 times.

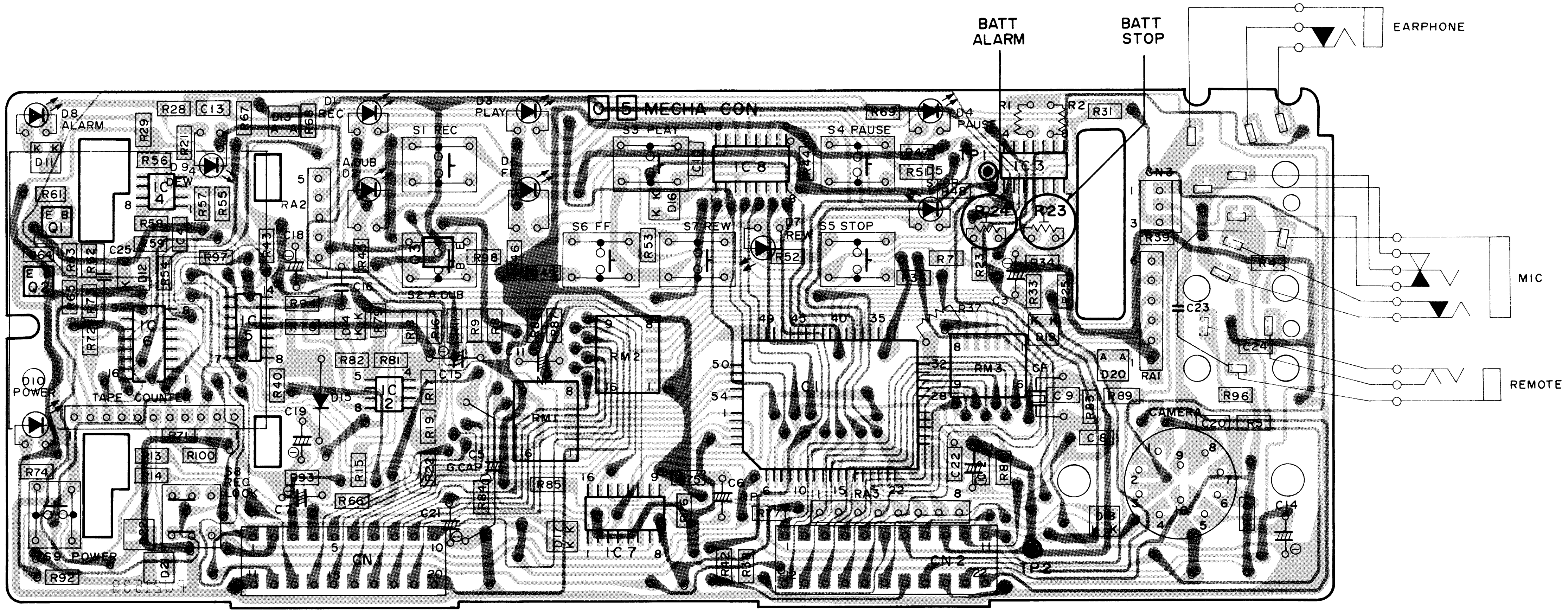
6.13 MECHANISM CONTROL SCHEMATIC DIAGRAM


IC1 HD44820 A83
IC2 µPC227G
IC3 UPC177G
IC4 µPC277G
IC5 LC4011BM
IC6 M54576FP
IC7 M54576FP
IC8 M54576FP
Q1 2SD601
Q2 2SD601
Q3 2SB709
TAPE COUNTER LC4052-01-03
S1 REC
S2 DUB
S3 PLAY
S4 PAUSE
S5 STOP
S6 F.F
S7 REW
S8 REC LOCK SW
S9 POWER
REC
A.DUB
PLAY
PAUSE
F.F
STOP
REW
BATT ALARM
BATT STOP
ALARM
POWER
DEW
REEL MOTOR
TP1
KEY IN
KEY SCAN 3
KEY SCAN 2
KEY SCAN 1
KEY SCAN 0
DUB TALLY
PLAY TALLY
PAUSE TALLY
STOP TALLY
FF TALLY
REW TALLY
REC TALLY /SERVO REC
COUNT DOWN
SUP REEL SENSOR
TU REEL SENSOR
REC LOCK
HLT
TEST
Vcc
POWER OFF
CAMERA PAUSE
DEW/COUNTER STOP
ENDSENS/SOL SW/ P SAVE SW
CASSETTE SW
REC SAFE SENSOR
LOADING END SW
UNLOADING END SW
AUDIO MUTE
NC
AUDIO DUB
VIDEO E-E
AUDIO REC
VIDEO REC MUTE
DRUM ON
CAP REV
CAP ON
RESET
OSC2
OSC1
GND
POWER OFF
SEARCH
SOL OFF/CAP BRAKE
SOL ON/CAP BRAKE
DRUM FF
CAP FG
LOADING
UNLOADING
REEL REV
REEL FWD
REEL SPEED CONTROL 0
REEL SPEED CONTROL 1
REEL SPEED CONTROL 2
REEL SPEED CONTROL 3
POWER ON RST
SUP FG
UP/DOWN
STAND BY
ZERO
RUN
VDD
RST
PLAY
PAL/NTSC
GND
CAMERA CONNECTOR
REMOTE
MIC
EARPHONE
CN3
AUDIO
AUDIO (GND)
CAMERA (GND)
CN1
UNREG 12V (CAMERA)
GND
NC
AUDIO
DEW SENSOR
SUPPLY REEL SENSOR
TAKE-UP REEL SENSOR
END SENS/SOL SW/P SAVE SW
CASSETTE SW (L)
REC SAFE SW (L)
LOADING END SW (L)
UNLOADING END SW (L)
AUDIO MUTE
AUDIO DUB (L)
VIDEO E-E (L)
AUDIO REC (L)
VIDEO REC MUTE
DRUM ON (L)
CAPSTAN FWD
CAPSTAN ON (L)
CN2
POWER OFF (L)
SEARCH (L)
SOLENOID OFF/CAP BRAKE
SOLENOID ON/CAP BRAKE
DRUM F.F
CAPSTAN FG
LOADING
UNLOADING
REEL REVERSE
REEL FWD
SERVO REC (L)
REEL SPEED CONTROL
POWER ON (L) CAMERA
STOP (L)
REG. 9V
UNREG. 12V
REG. 5V
GND
PAUSE (L)
POWER ON (LOCAL, REMOTE)
VIDEO
CAMERA GND
05 MECHA-CON

A B C D E F G H

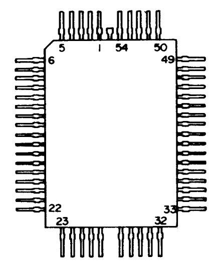
1 2 3 4 5 6

6.14 MECHANISM CONTORL CIRCUIT BOARD

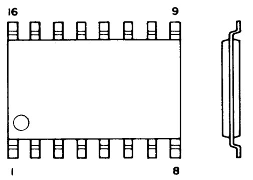

BATT ALARM
BATT STOP
EARPHONE
MIC
REMOTE
MECHA CON
D8 ALARM
D1 REC
D3 PLAY
D4 PAUSE
S1 REC
S3 PLAY
S4 PAUSE
S5 STOP
S6 FF
S7 REW
S2 A.DUB
D2 A.DUB
D6 FF
D7 REW
D9 DEW
D10 POWER
S9 POWER
S8 REC LOCK
TAPE COUNTER
CAMERA
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
CN1
CN2
CN3
RM1
RM2
RM3
RA1
RA2
RA3
TP1
TP2
Q1
Q2
R23
R24

Drawing magnified 1.5 times.

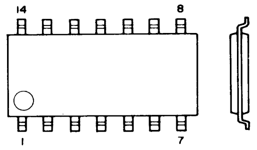
HD44820A83


5
1
54
50
6
49
22
23
32
33

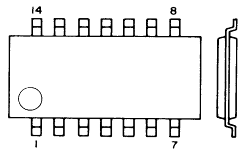
M54576FP



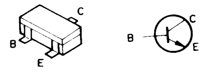
UPC177G



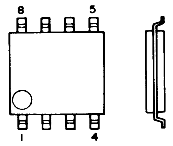
LC4011BM



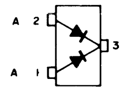
2SD601QRS (Chip)



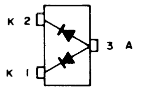
UPC277G

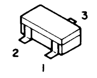


MA151WK

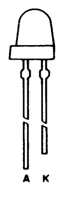


MA151WA

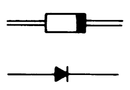




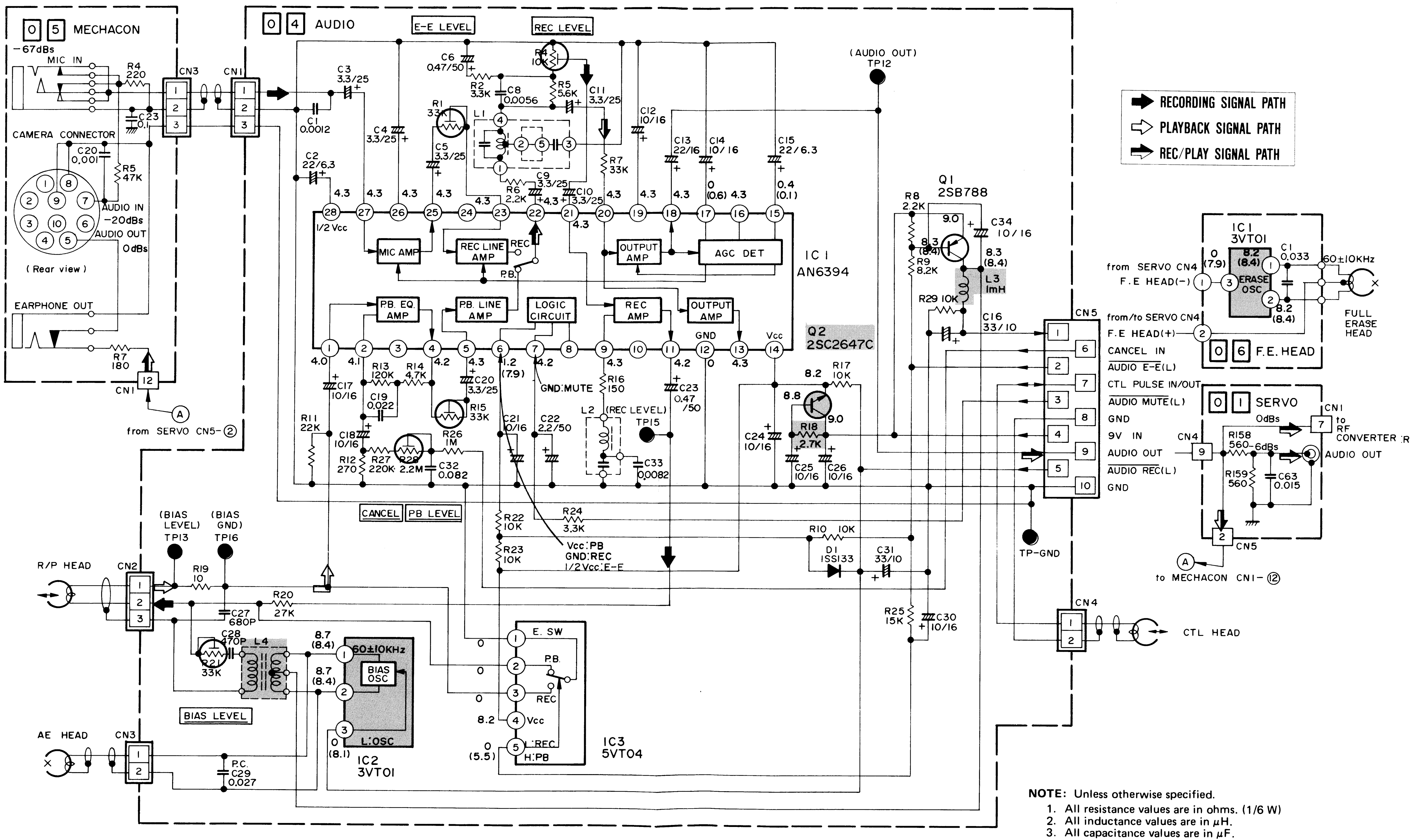
TLUR143-DE



10E2



6.15 AUDIO SCHEMATIC DIAGRAM



RECORDING SIGNAL PATH
PLAYBACK SIGNAL PATH
REC/PLAY SIGNAL PATH
05 MECHACON
-67dBs
MIC IN
R4 220
CN3
CN1
C23 0.1
CAMERA CONNECTOR
C20 0.001
R5 47K
AUDIO IN -20dBs
AUDIO OUT 0dBs
(Rear view)
EARPHONE OUT
R7 180
from SERVO CN5-⑫
04 AUDIO
E-E LEVEL
REC LEVEL
C3 3.3/25
C1 0.0012
C2 22/6.3
C4 3.3/25
C6 0.47/50
R2 3.3K
C8 0.0056
R3 10K
R5 5.6K
C11 3.3/25
R1 33K
L1
C5 3.3/25
R6 2.2K
C9 3.3/25
C10 3.3/25
R7 33K
C12 10/16
C13 22/16
C14 10/16
C15 22/6.3
1/2 Vcc
MIC AMP
REC LINE AMP
OUTPUT AMP
AGC DET
IC1 AN6394
PB. EQ. AMP
PB. LINE AMP
LOGIC CIRCUIT
REC AMP
OUTPUT AMP
GND
Vcc
C17 10/16
R13 120K
R14 4.7K
C19 0.022
C20 3.3/25
R15 33K
R11 22K
C18 10/16
R12 270
R27 220K
R28 2.2M
R26 1M
C32 0.082
C21 10/16
C22 2.2/50
GND:MUTE
R16 150
L2 (REC LEVEL)
TP15
C23 0.47/50
C33 0.0082
CANCEL
PB LEVEL
R22 10K
R23 10K
R24 3.3K
Vcc:PB GND:REC 1/2Vcc:E-E
(AUDIO OUT) TP12
Q1 2SB788
R8 2.2K
R9 8.2K
C34 10/16
L3 1mH
R29 10K
C16 33/10
Q2 2SC2647C
R17 10K
C24 10/16
R18 2.7K
C25 10/16
C26 10/16
R10 10K
D1 1SS133
C31 33/10
R25 15K
C30 10/16
TP-GND
CN5
CN4
CTL HEAD
(BIAS LEVEL) TP13
(BIAS GND) TP16
R/P HEAD
CN2
R19 10
C27 680P
R20 27K
C28 470P
L4
R21 33K
BIAS LEVEL
60±10KHz
BIAS OSC
L:OSC
IC2 3VT01
E. SW
P.B.
REC
Vcc
L:REC H:PB
IC3 5VT04
AE HEAD
CN3
P.C. C29 0.027
IC1 3VT01
C1 0.033
60±10KHz
ERASE OSC
FULL ERASE HEAD
from SERVO CN4 F.E HEAD(-)
from/to SERVO CN4 F.E HEAD(+)
06 F.E. HEAD
CANCEL IN
AUDIO E-E(L)
CTL PULSE IN/OUT
AUDIO MUTE(L)
GND
9V IN
AUDIO OUT
AUDIO REC(L)
GND
01 SERVO
0dBs
CN1 to RF CONVERTER
R158 560
-6dBs
AUDIO OUT
R159 560
C63 0.015
to MECHACON CN1-⑫

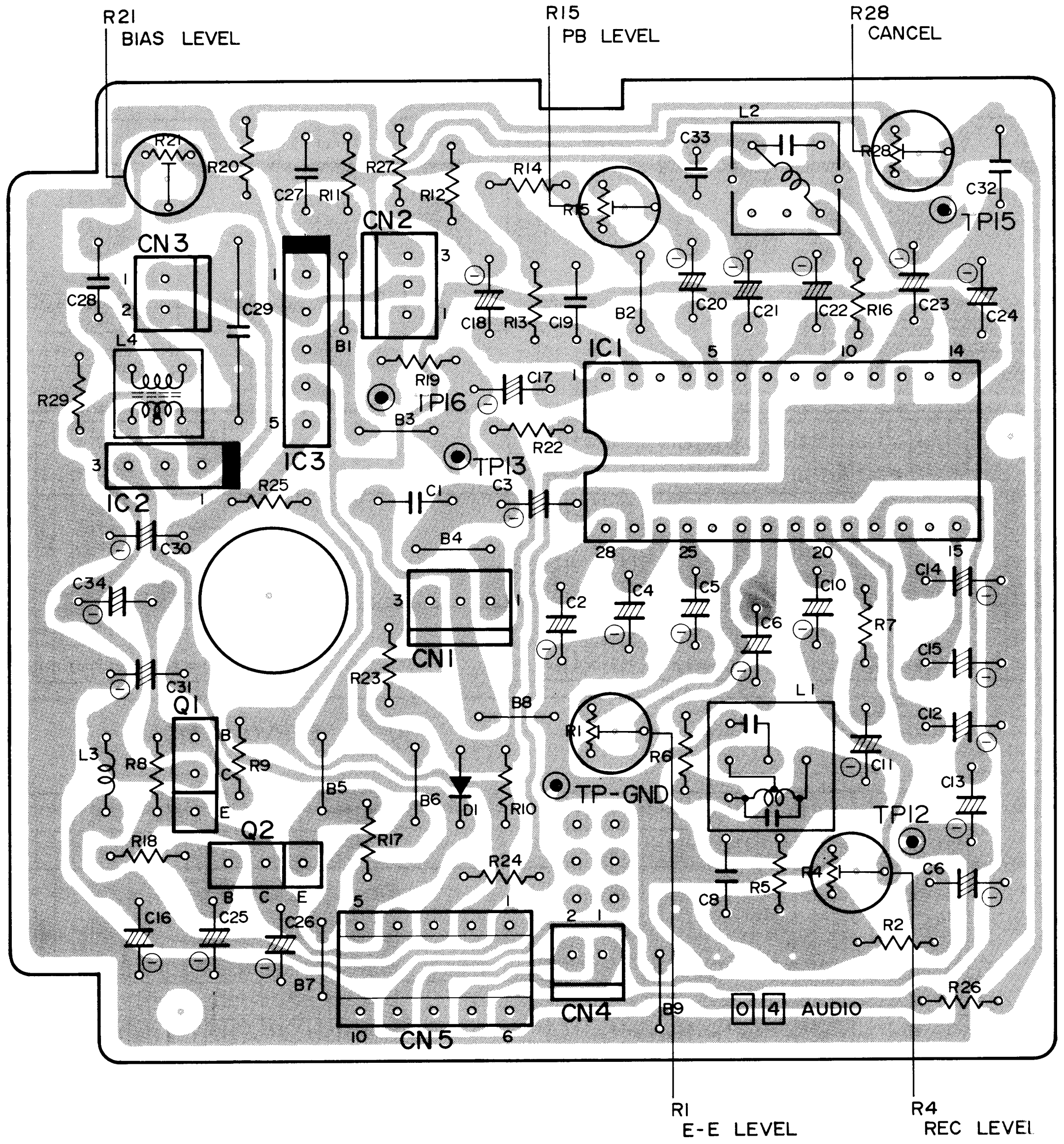
NOTE: Unless otherwise specified.

1. All resistance values are in ohms. (1/6 W)
2. All inductance values are in μH.
3. All capacitance values are in μF.
4. Voltages are DC-measured with a digital voltmeter during recording mode.
5. Where voltage differs between recording and playback, the voltage during playback is shown in parentheses.
6. Shaded (▨) parts are critical for safety. Replace only with specified part numbers.

6-16 AUDIO SCHEMATIC (MECHA. CON BOARD)

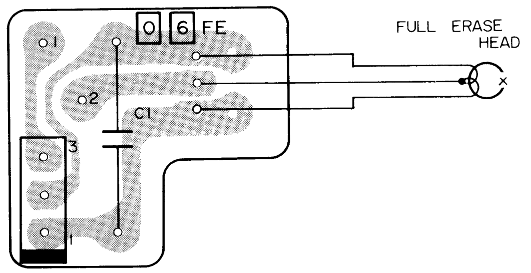
6.16 AUDIO CIRCUIT BOARD

– AUDIO CIRCUIT BOARD –


R21
BIAS LEVEL
R15
PB LEVEL
R28
CANCEL
R20
C27
R11
R27
CN2
R12
R14
R15
C33
L2
R28
C32
TP15
CN3
C28
C29
IC3
B1
C18
R13
C19
B2
C20
C21
C22
R16
C23
C24
L4
R29
R19
C17
IC1
TP16
B3
R22
TP13
IC2
R25
C1
C3
C30
B4
C34
CN1
C2
C4
C5
C6
C10
R7
C14
C15
R23
C31
Q1
B8
R1
R6
L1
C12
L3
R8
R9
B5
B6
D1
R10
TP-GND
C11
C13
TP12
R18
Q2
R17
R24
R5
R4
C6
C8
C16
C25
C26
B7
CN5
CN4
B9
AUDIO
R2
R26
R1
E-E LEVEL
R4
REC LEVEL

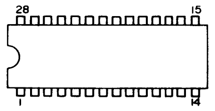
Drawing magnified 2 times.

– FULL ERASE HEAD BOARD –

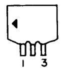

FE
C1
FULL ERASE
HEAD

Drawing magnified 2 times.

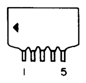
AN6394



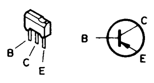
3VT01



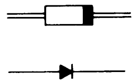
5VT04



2SB788STU
2SC2647C



1SS133



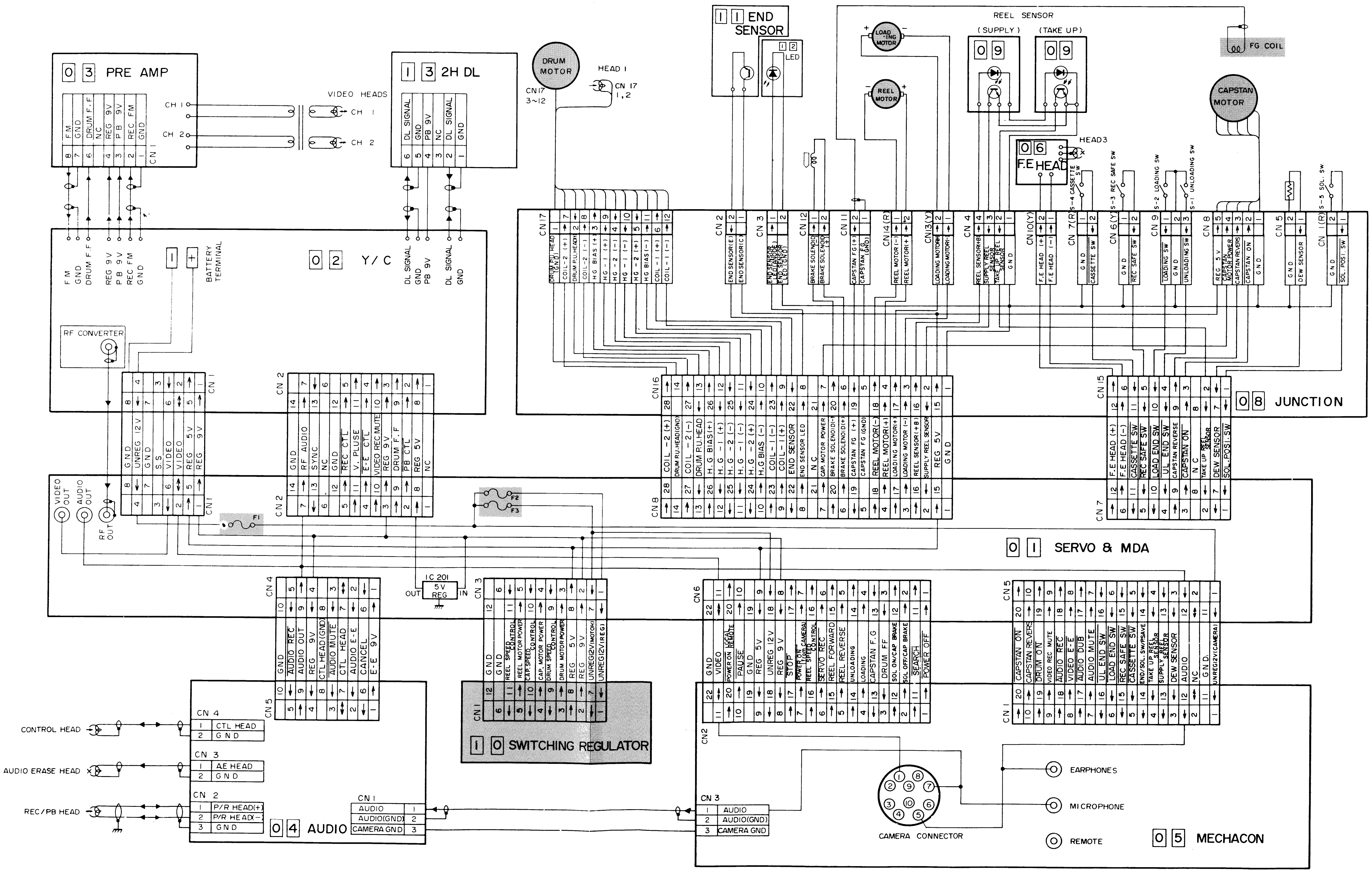
6.17 OVERALL WIRING DIAGRAM

NAME OF PWB ASS'Y

01	SERVO & MDA
02	Y/C
03	PRE AMP
04	AUDIO
05	MECHACON
06	F.E HEAD
07	A.C HEAD
08	JUNCTION
09	REEL SENSOR
10	SWITCHING REGULATOR
11	END SENSOR
12	LED
13	2H DL

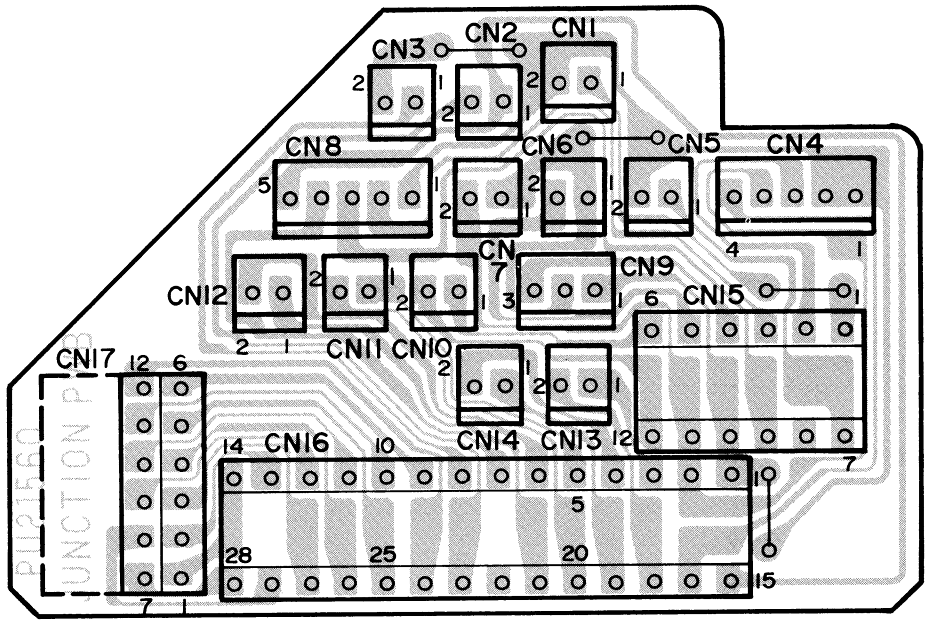
10 PIN CAMERA CONNECTOR

1	VIDEO IN/OUT
2	VIDEO GND
3	BATT. ALARM & TAPE RUN
4	POWER CTL
5	AUDIO OUT
6	PAUSE IN
7	AUDIO IN
8	AUDIO GND
9	GND
10	12V OUT


03 PRE AMP
CN 1
FM
GND
DRUM F.F
NC
REG 9V
PB 9V
REC FM
GND
CH 1
CH 2
VIDEO HEADS
13 2H DL
DL SIGNAL
GND
PB 9V
NC
DL SIGNAL
GND
DRUM MOTOR
HEAD 1
CN 17 1,2
CN17 3~12
11 END SENSOR
12 LED
LOAD-ING MOTOR
REEL MOTOR
REEL SENSOR
(SUPPLY)
(TAKE UP)
09
FG COIL
CAPSTAN MOTOR
HEAD3
06 F.E HEAD
S-4 CASSETTE SW
S-3 REC SAFE SW
S-2 LOADING SW
S-1 UNLOADING SW
S-5 SOL. SW
02 Y/C
BATTERY TERMINAL
RF CONVERTER
CN 17
CN 2
CN 3
CN 12
CN 11
CN14(R)
CN13(Y)
CN 4
CN10(Y)
CN 7(R)
CN 6(Y)
CN 9
CN 8
CN 5
CN 1(R)
CN16
CN15
08 JUNCTION
CN 8
CN 7
01 SERVO & MDA
VIDEO OUT
AUDIO OUT
RF OUT
F1
F2
F3
IC 201 5V REG
OUT
IN
CN 4
CN 3
CN6
CN5
CN 5
CN 1
CN 2
10 SWITCHING REGULATOR
CONTROL HEAD
AUDIO ERASE HEAD
REC/PB HEAD
CN 4
1 CTL HEAD
2 GND
CN 3
1 AE HEAD
2 GND
CN 2
1 P/R HEAD(+)
2 P/R HEAD(−)
3 GND
CN 1
AUDIO 1
AUDIO(GND) 2
CAMERA GND 3
04 AUDIO
CN 3
1 AUDIO
2 AUDIO(GND)
3 CAMERA GND
CAMERA CONNECTOR
EARPHONES
MICROPHONE
REMOTE
05 MECHACON

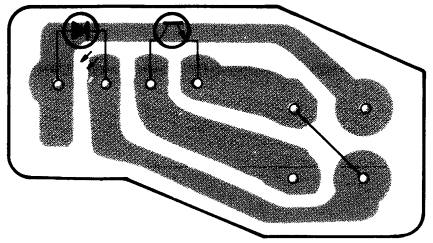
6.18 JUNCTION AND SENSOR CIRCUIT BOARDS

– JUNCTION BOARD –

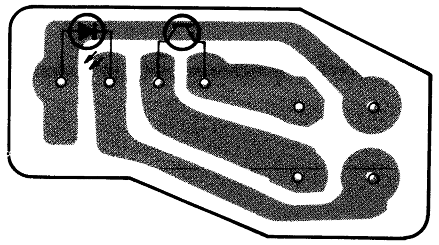

CN1
CN2
CN3
CN4
CN5
CN6
CN7
CN8
CN9
CN10
CN11
CN12
CN13
CN14
CN15
CN16
CN17
PU21560
JUNCTION P.B.

Drawing magnified 2 times.

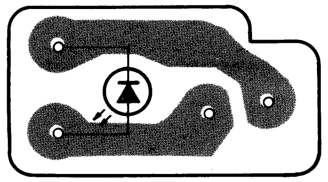
– TAKE-UP REEL SENSOR BOARD –



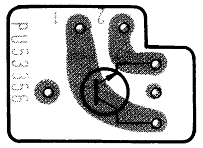
–SUPPLY REEL SENSOR BOARD –



– LED BOARD –

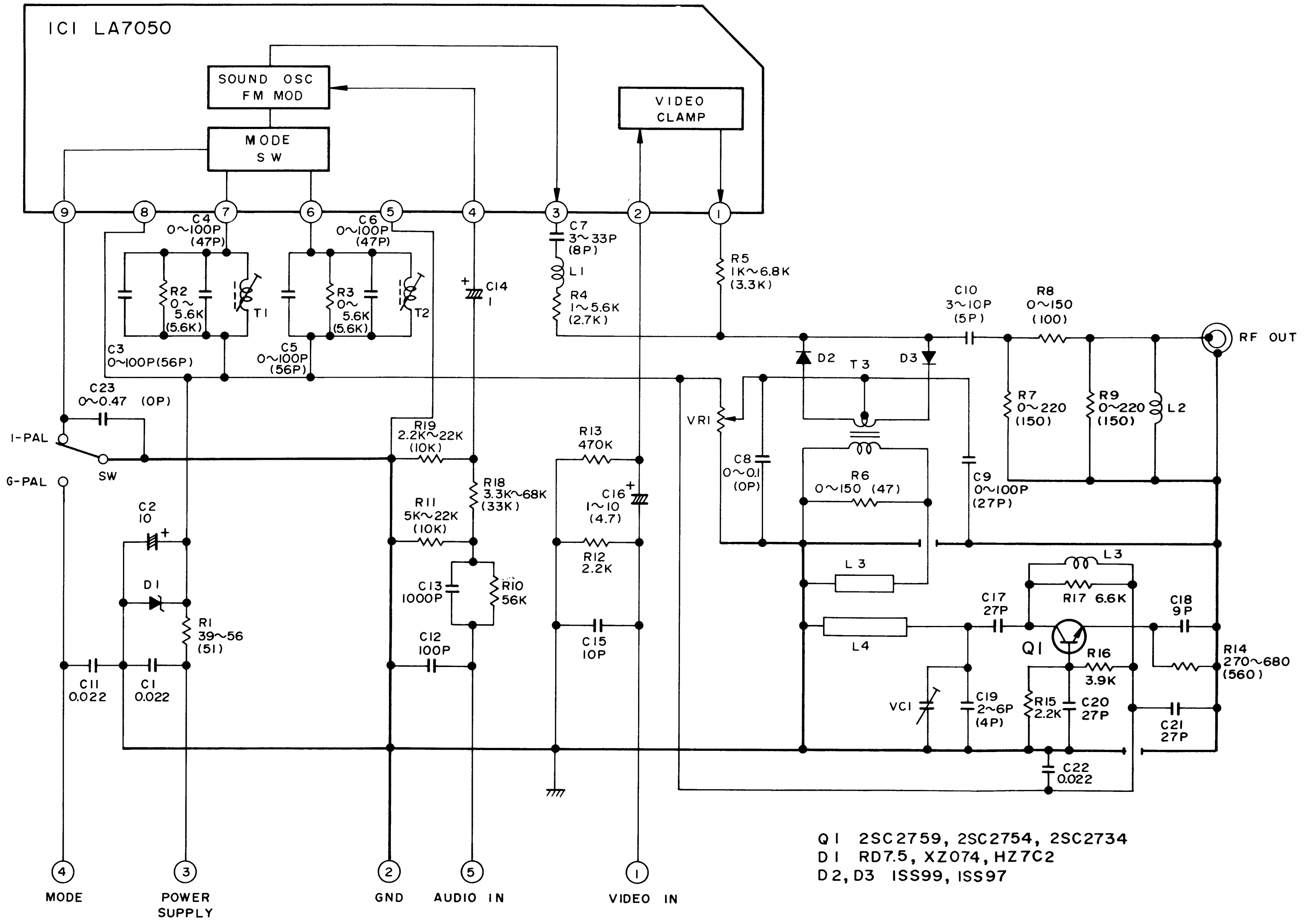


– END SENSOR BOARD –



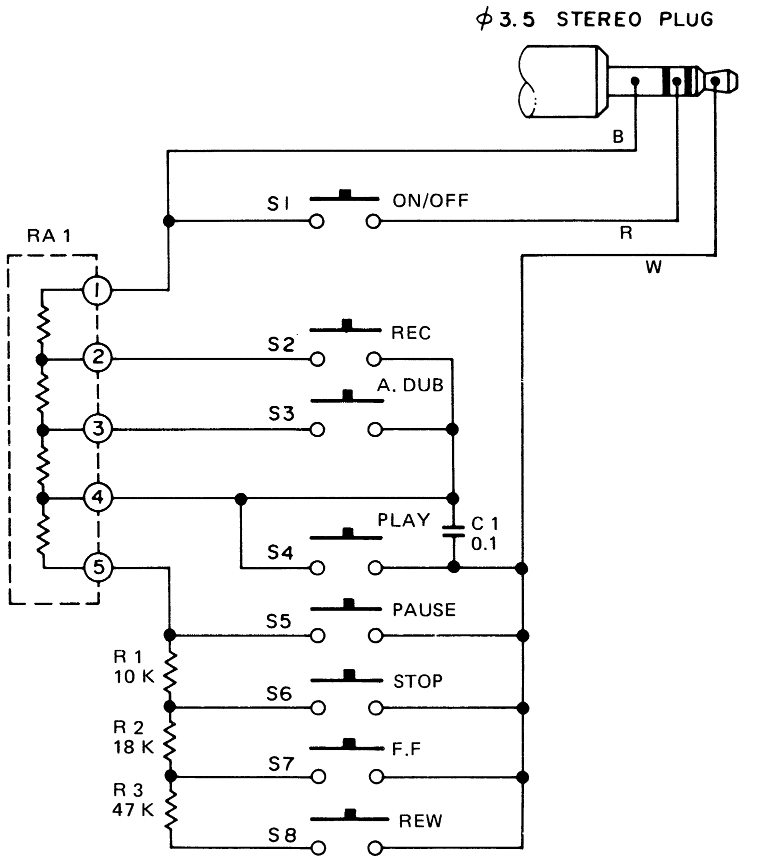
Drawing magnified 1.5 times.

6.19 RF CONVERTER SCHEMATIC DIAGRAM


IC1 LA7050
SOUND OSC
FM MOD
MODE
SW
VIDEO
CLAMP
9 8 7 6 5 4 3 2 1
C4 0~100P (47P)
C6 0~100P (47P)
R2 0~5.6K (5.6K)
T1
R3 0~5.6K (5.6K)
T2
C3 0~100P(56P)
C5 0~100P (56P)
C7 3~33P (8P)
L1
R4 1~5.6K (2.7K)
C14 1
R5 1K~6.8K (3.3K)
C23 0~0.47 (0P)
I-PAL
G-PAL
SW
R19 2.2K~22K (10K)
R18 3.3K~68K (33K)
R11 5K~22K (10K)
C13 1000P
R10 56K
C12 100P
R13 470K
C16 1~10 (4.7)
R12 2.2K
C15 10P
C2 10
D1
R1 39~56 (51)
C11 0.022
C1 0.022
VR1
C8 0~0.1 (0P)
D2
T3
D3
R6 0~150 (47)
L3
L4
C9 0~100P (27P)
C10 3~10P (5P)
R8 0~150 (100)
R7 0~220 (150)
R9 0~220 (150)
L2
RF OUT
L3
R17 6.6K
C17 27P
C18 9P
Q1
R16 3.9K
R14 270~680 (560)
VC1
C19 2~6P (4P)
R15 2.2K
C20 27P
C21 27P
C22 0.022
4 MODE
3 POWER SUPPLY
2 GND
5 AUDIO IN
1 VIDEO IN

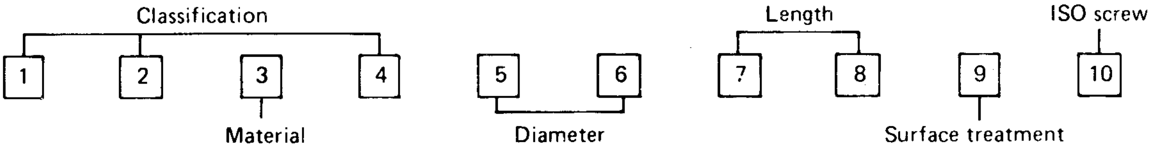
Q1 2SC2759, 2SC2754, 2SC2734
D1 RD7.5, XZ074, HZ7C2
D2, D3 1SS99, 1SS97

6.20 RM-P3U REMOTE CONTROL UNIT SCHEMATIC DIAGRAM


φ3.5 STEREO PLUG
B
R
W
RA 1
1
2
3
4
5
S1 ON/OFF
S2 REC
S3 A. DUB
S4 PLAY
C1 0.1
S5 PAUSE
S6 STOP
S7 F.F
S8 REW
R1 10K
R2 18K
R3 47K

SECTION 7
EXPLODED VIEWS AND PARTS LIST

7.1 SCREW CODING



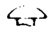
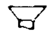
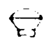
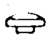
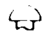
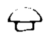
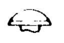
Classification (first digit)

Symbol Letter	Name
S	Normal screw
N	Assembly screw
L	"
D	"
M	Wood screw
F	Feather screw
T	Set screw
Y	"
B	Bolt
N	Nut
W	Washer
R	E-ring
E	Eyelet
P	Spring
G	Washer head screw

Material (third digit)

Symbol Letter	Material
S	Steel
E	Stainless steel
C	Cast iron
U	Bronze
B	Brass
P	Phosphor bronze
N	German silver
Y	Brass
A	Aluminum
Z	Zinc alloy
K	Polycarbonate

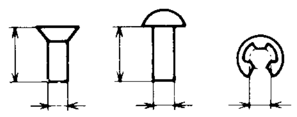
Shape of Screw Head (second digit)

Symbol Letter		Shape of Screw Head
P		Pan head
S		Flat countersunk head
H		Oval countersunk head
D		Binding head
R		Round head
B		Round head
T		Truss head

Type of Screw (fourth digit)

Symbol Letter	Type of Screw
P	Cross-Recessed head screw
A	Tapping screw
B	Special tapping screw
T	Special tapping screw
E	Special tapping screw
F	Special tapping screw

Diameter and Length of Screw (fifth – eighth digit)



– Example –

S P B P 3 0 0 6 Z S

(Diameter x 10) (Length)

Diameter : 3 mm

Length : 6 mm

Surface Treatment (ninth digit)

Symbol Letter	Surface Treatment
Z	Galvanization, dichromic acid treatment (MFZn2-C)
N	Nickel plating (MFNi2, MFNil)
R	Chrome plating (MBCr2, MBCr1)
G	Silver plating (SP4)
W	Nichrome platings
P	Phosphite treatment
B	Bronze plating
M	Black coloring after galvanization
A	Red coloring after galvanization
C	Blue coloring after galvanization
T	Green coloring after galvanization
V	Violet coloring after galvanization
F	Iron with black coloring

7.2 LAYOUT OF MAIN MECHANICAL PARTS

7.2.1 Top view and parts identification

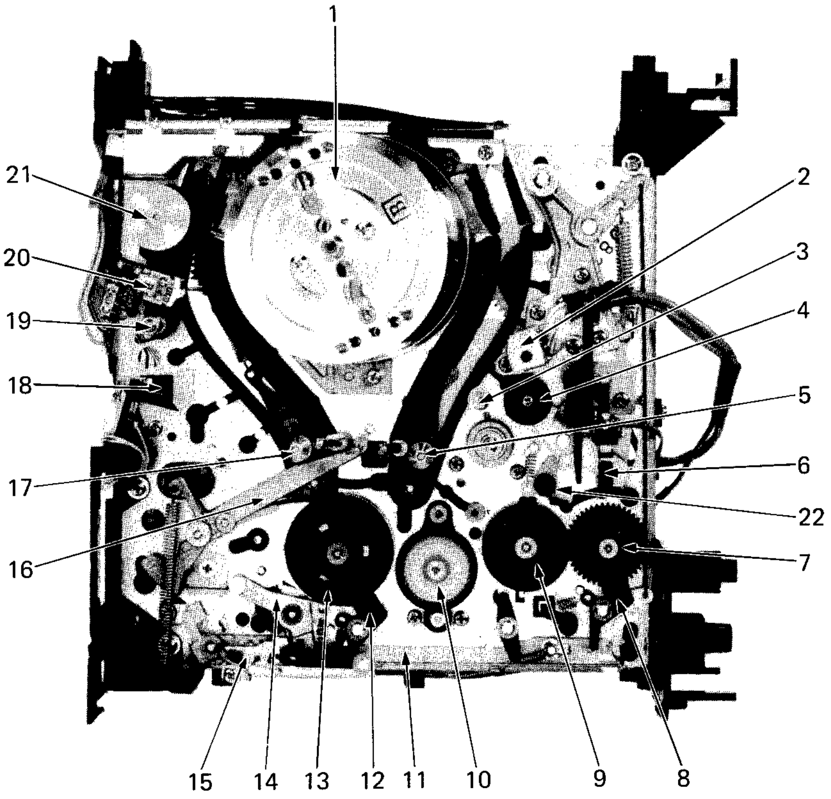


Fig. 7-1 Top view

Symbol No.	Part Name	Part No.
1	Upper Drum Assembly	PU33620B
2	Audio/Control Head	PU54395
3	Tape Guide	PU53629-2
4	Pinch Roller Assembly	PU54739A
5	Take-up Guide Roller Ass'y	PU53046A
6	Cassette Switch	PU52732
7	Take-up Gear	PU52991
8	Take-up Brake Arm Ass'y	PU53012A
9	Take-up Pulley	PU52992
10	Idler Arm	PU52990
11	Slide Lever Ass'y	PU53002B
12	Supply Brake Arm Ass'y	PU53015A
13	Supply Reel Disk	PU53000
14	Cancel Lever Ass'y	PU53017A
15	REC Safety Switch	PU53083
16	Tension Arm Ass'y	PU52997A
17	Supply Pole Base Ass'y	PU53044A
18	Dew Sensor	PU53091
19	Guide Pole	PU53058
20	Full Erase Head	PU54397
21	Roller Ass'y	PU54742A
22	Tension Brake Ass'y	PU54198A

Table 7-1

7.2.2 Bottom view and parts identification

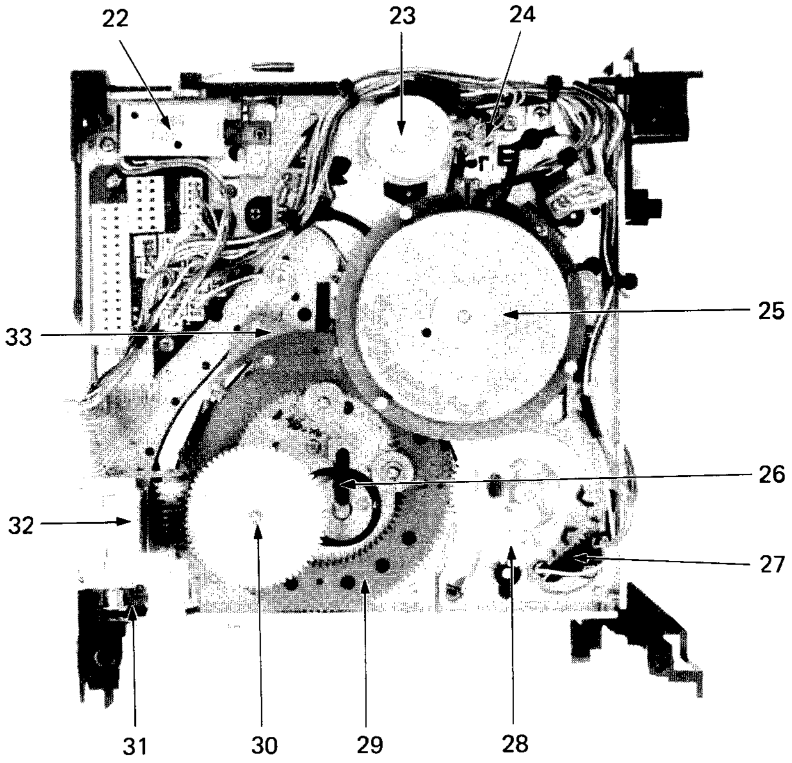


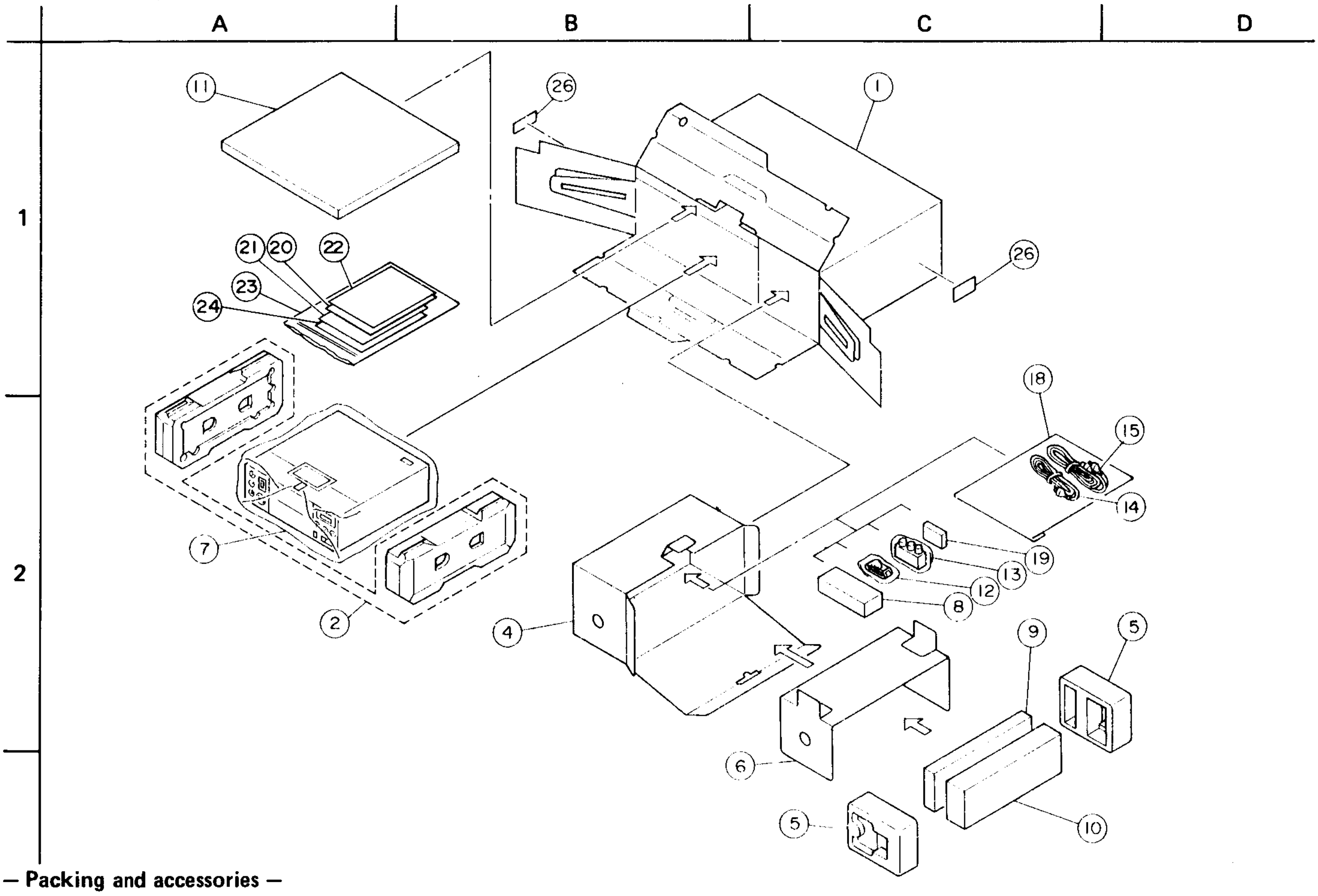
Fig. 7-2 Bottom view

Symbol No.	Part Name	Part No.
22	Brake Solenoid	PU53004
23	Reel Motor Ass'y	PU53585V
24	Solenoid Switch	PU53083
25	Capstan Motor	PU53066V
26	Brush	PU53092
27	Loading Switch	PU53088
28	Cam Gear	PU33551-2
29	Drive Ring Ass'y (L)	PU53024A
30	Worm Wheel Ass'y	PU53036A
31	Loading Belt	PUM30003-6
32	Loading Motor	PU53039V
33	Drive Ring Ass'y (R)	PU53021C

Table 7-2

7.3 EXPLODED VIEWS AND PARTS LIST

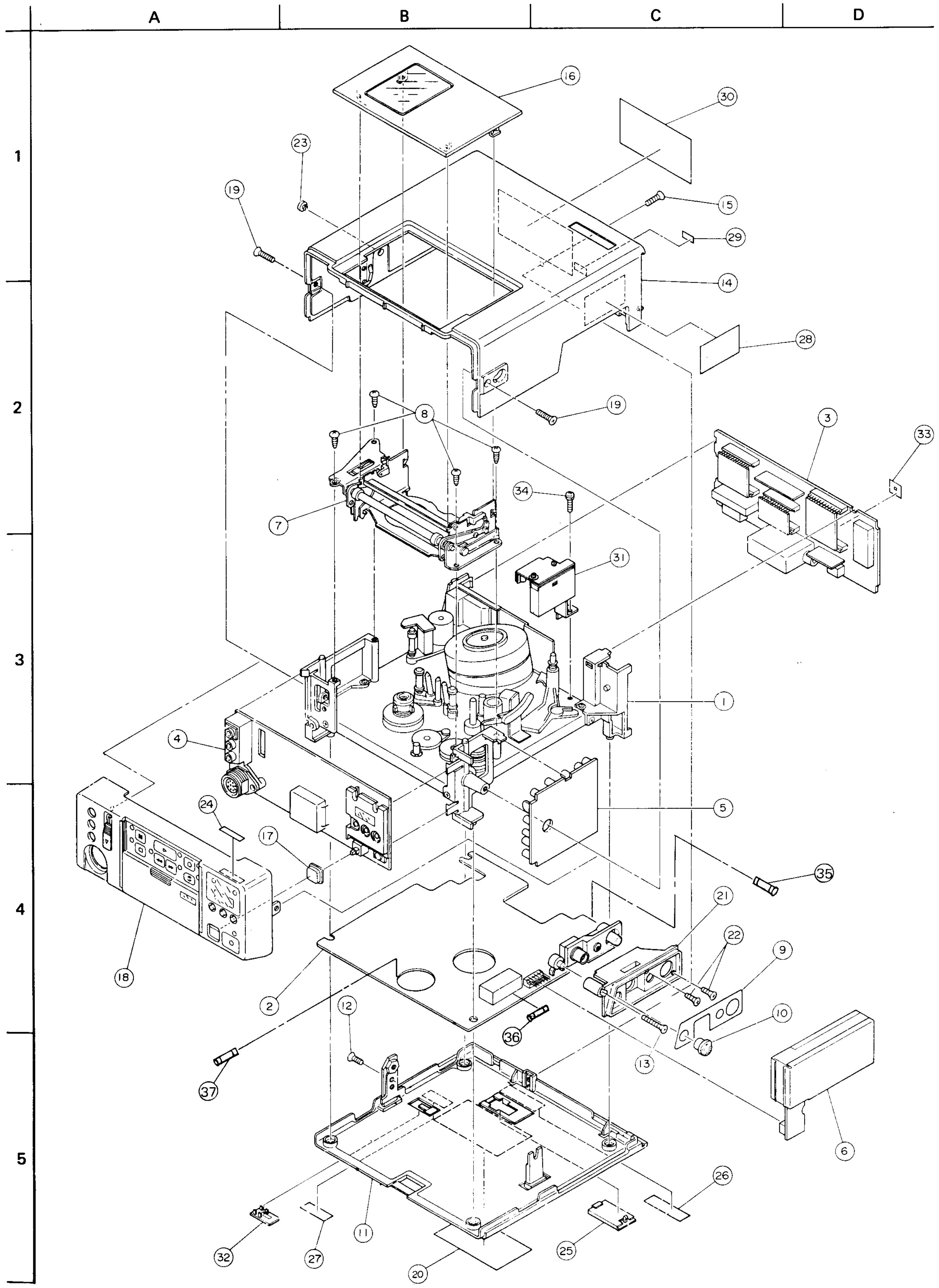
7.3.1 Packing and accessories



— Packing and accessories —

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	PU21516-3	Packing Case	for HR-C3EG	1-C	1
	〃 -4	〃	for HR-C3EK		1
2	PU33766A	Cushion Ass'y		2-A	1
3	–	–		–	–
4	PU33768	Accessory Case		2-B	1
5	PUP20321	Cushion (C)		3-B	1
6	PU33770	Spacer		3-B	1
7	PUM30021-31	Poly Bag		2-A	1
⚠ 8	PU33697B	Remote Control Unit	RM-P3U	2-C	1
⚠ 9	PU53150B	Battery Pack (S)	NB-P3U	2-C	1
⚠ 10	PU53200D-11	Battery Charger	BB-P3EG	3-C	1
⚠	PU53200E	〃	BB-P3EK	3-C	1
11	PU53639A-1	Carrying Case	CB-P3U	1-A	1
12	PU53589	Shoulder Strap		2-C	1
⚠ 13	PU53593-3	ANT Select Box	for HR-C3EG	2-C	1
⚠ 14	PU43294F	Cable Assembly (RF)		2-C	1
⚠ 15	PU43294H	Cable Assembly (VHF)	for HR-C3EG	2-C	1
16	–	–		–	–
17	–	–		–	–
18	QPGA015-03005	Poly Bag		2-C	1
19	PEC-30	Cassette Tape	EC-30	2-C	1
⚠ 20	PU21597	Instruction Guide	for HR-C3EG	1-A	1
⚠	PU33971	〃	for HR-C3EK		1
⚠ 21	PU30425-499	Instructions	for HR-C3EG	1-A	1
⚠	PU30425-536	〃	for HR-C3EK		1
22	PU32004	Guarantee Card	for HR-C3EK	1-A	1
23	QPGB024-03404	Poly Bag		1-A	1
⚠ 24	PU30425-517	Instructions	for BB-P3EG/EK	1-A	1
25	–	–		–	–
26	PUP40329	SER. No. Sticker		1-B, C	2

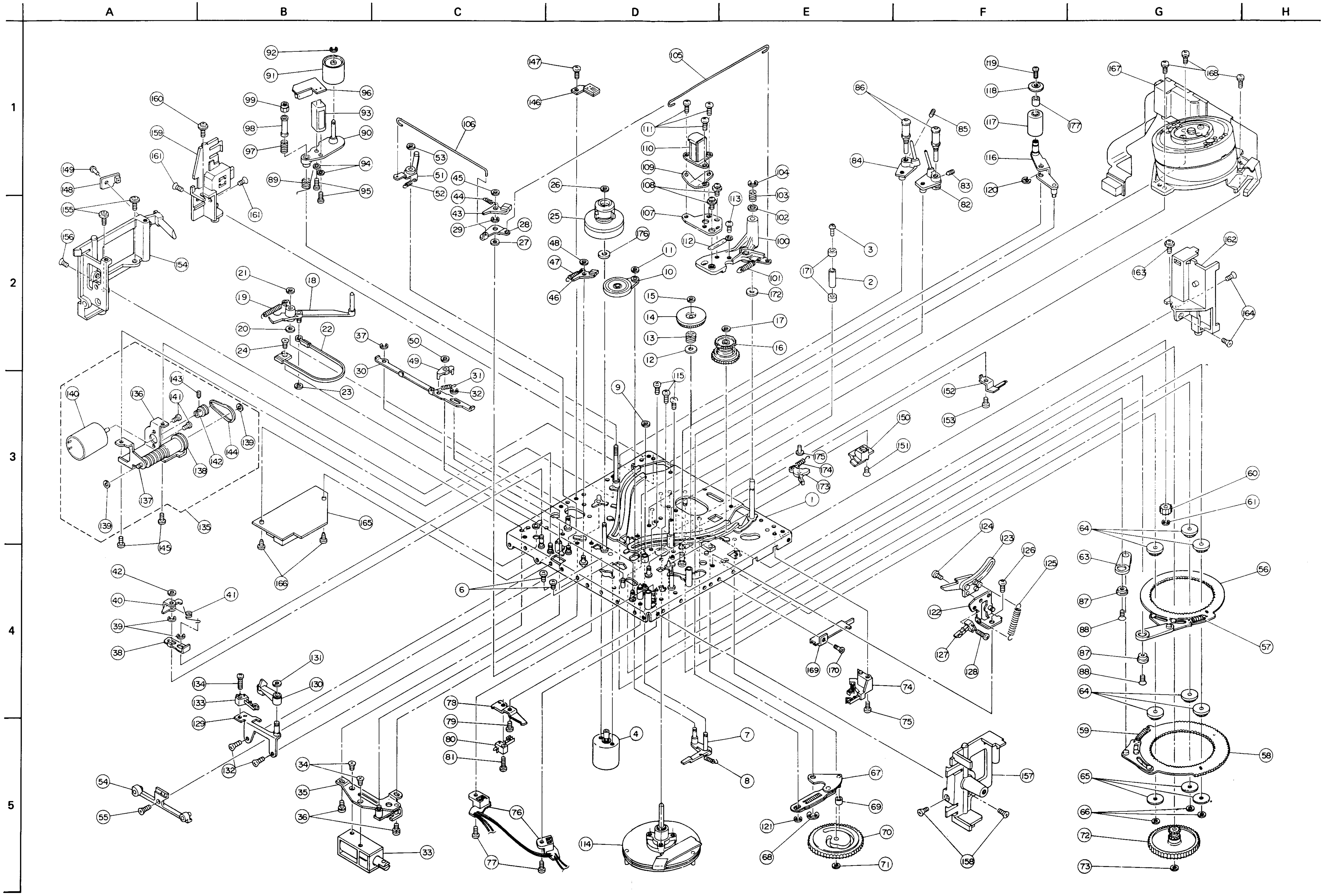
7.3.2 Cabinet assembly



– Cabinet assembly list –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	–	Mechanism Assembly	See Section 7.3.3.	3-C	1
2	–	SERVO & MDA Board Assembly	See Section 8.2.1.	4-A	1
3	–	Y/C Board Assembly	See Section 8.2.2.	2-D	1
4	–	MECHACON Board Assembly	See Section 8.2.5.	3-A	1
5	–	AUDIO Board Assembly	See Section 8.2.4.	4-C	1
⚠ 6	–	SWITCHING REG. Assembly	See Section 8.2.9.	5-D	1
7	–	Cassette Housing Assembly	See Section 7.3.5.	3-A	1
8	SBSA2608Z	Tapping Screw		2-B	4
⚠ 9	PU33811	Connector Panel		4-D	1
10	PU53196	VR Knob		4-D	1
⚠ 11	PU21393E	Bottom Cover Assembly	Incl. (25), (26), (27)	5-B	1
12	SSSP2606Z	Screw		4-B	1
13	SSSP2620Z	"		5-C	1
⚠ 14	PU10544E	Top Cover Assembly	Incl. (23), (28), (29), (30)	2-C	1
15	SSSP2606M	Screw		1-C	1
16	PU33631E	Cassette Cover Assembly	for HR-C3EK	1-C	1
	PU33631F	"	for HR-C3EG		1
17	PU53191-1-2	Push Button		4-A	1
⚠ 18	PU21394E-6	Front Cover Assembly	Incl. (24) for HR-C3EK	4-A	1
	PU21394F-6	"	for HR-C3EG		1
19	SSSP3008MS	Screw		1-A, 2-C	2
⚠ 20	PU33742-5-7	Rating Label	for HR-C3EK	5-B	1
⚠	PU33742-15	"	for HR-C3EG		1
21	PU33810	Connector Cover		4-C	1
22	SSSB2606M	Tapping Screw		4-C	2
23	PU54382	Push Cap		1-B	1
⚠ 24	PU54559	Label	for HR-C3EK	4-A	1
25	PU33844-8	Cap		5-C	1
26	PU33965	Label		5-C	1
27	PU33744	Select Switch Label		5-B	1
⚠ 28	PU47385	Label		2-D	1
29	PU33961	"		2-C	1
⚠ 30	PU33745	Battery Caution Label		1-C	1
31	–	2H DL Board Assembly	See Section 8.2.12.	3-C	1
32	PU33649	Slide Cover		5-A	1
33	PQ40048-1-1	Spacer		2-D	1
34	LPSP2605Z	Screw		2-C	1
⚠ 35	QMF51A2-3R15	Fuse	F1 (T 3.15A)	4-D	1
⚠ 36	" -R63	"	F2 (T 0.63A)	5-B	1
⚠ 37	" -R63	"	F3 (T 0.63A)	5-A	1

7.3.3 Mechanism assembly


A
B
C
D
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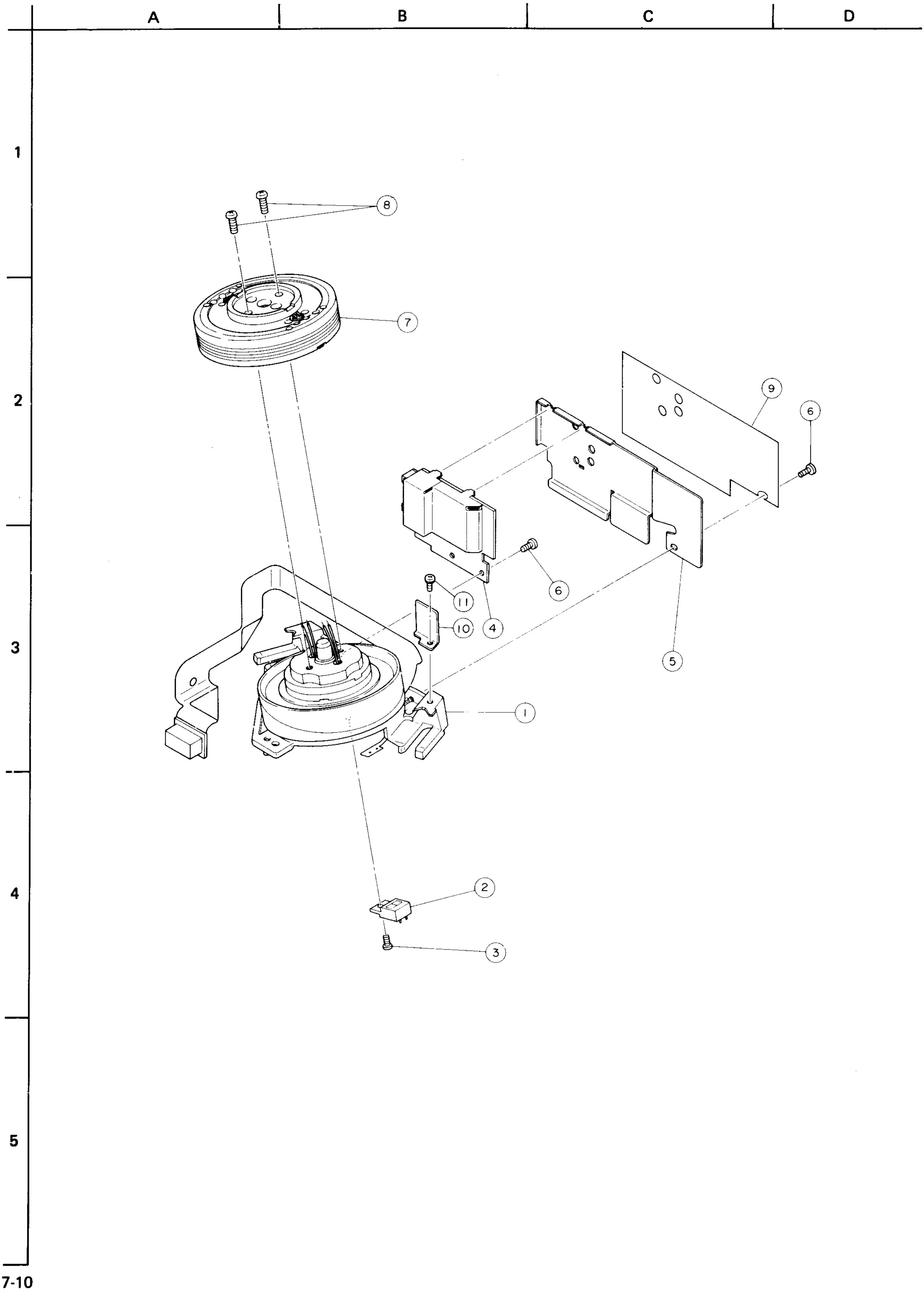
– Mechanism assembly list –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	PU10536B-2	Deck Assembly	incl. (2) and (3)	3-E	1
2	PU53629-2	Tape Guide		2-E	1
3	SSSP2005Z	Screw		2-E	1
⚠ 4	PU53585V	Reel Motor Assembly	Incl. (5)	5-D	1
5		–		–	–
6	SPSP2604Z	Screw		4-C	2
7	PU52989A	Idler Lever Assembly	Incl. (8)	5-E	1
8	PUM30001-69	Spring		5-E	1
9	PUM30017-7	Slit Washer		3-D	1
10	PU52990	Idler Arm		2-D	1
11	PUM30017-7	Slit Washer		2-D	1
12	Q03093-832	Washer		2-D	1
13	PUM30002-36	Spring		2-D	1
14	PU52992	Take-up Pulley		2-D	1
15	PUM30017-5	Slit Washer		2-D	1
16	PU52991-2	Take-up Gear		2-E	1
17	PUM30017-7	Slit Washer		2-E	1
18	PU52997A	Tension Arm Assembly	Incl. (19)	2-B	1
19	PUM30001-80	Spring		2-B	1
20	Q03093-827	Washer		2-B	1
21	PUM30017-5	Slit Washer		2-B	1
22	PU52993A	Tension Band Assembly		2-B	1
23	PUM30017	Slit Washer		3-B	1
24	SSSP2606Z	Screw		2-B	1
25	PU53000	Supply Reel Disk		2-D	1
26	PUM30017-5	Slit Washer		1-D	1
27	Q03093-819	Washer		2-C	1
28	PU53001	Connect Lever		2-C	1
29	REE3000	E-Ring		2-C	1
30	PU53002B	Slide Lever Assembly	Incl. (31)	3-B	1
31	PU53314-2	Spring		3-C	1
32	REE2500	E-Ring		3-C	1
⚠ 33	PU53004	Brake Solenoid		5-C	1
34	SSSP2603Z	Screw		5-B	2
35	PU53005A	Solenoid Bracket Assembly		5-B	1
36	PU54082	Screw		5-B	2
37	REE2500	E-Ring		2-B	1
38	PU53009	Eject Lock Lever		4-A	1
39	REE2500	E-Ring		4-A	2
40	PU53010	Eject Lock Cam		4-A	1
41	PU53011	E.L. Lever Spring		4-B	1
42	Q03093-826	Washer		4-A	1
43	PU53012A	Brake Arm Assembly	Incl. (44)	2-C	1
44	PUM30001-71	Spring		2-C	1
45	PUM30017-4	Slit Washer		1-C	1
46	PU53015A	Brake Arm Assembly	Incl. (47)	2-D	1
47	PUM30001-78	Spring		2-D	1
48	PUM30017-4	Slit Washer		2-D	1
49	PU53016	Idler Cancel Lever		3-C	1
50	PUM30017-4	Slit Washer		2-C	1
51	PU53017A	Cancel Lever Assembly	Incl. (52)	1-C	1
52	PUM30001-79	Spring		2-C	1
53	PUM30017-6	Slit Washer		1-C	1
54	PU53020	Connector Base		5-A	1
55	SPSP2606Z	Screw		5-A	1

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
56	PU53021C	Drive Ring Assembly (R)	Incl. (57)	4-H	1
57	PUM30001-74	Spring		5-H	1
58	PU53024A	Drive Ring Assembly (L)	Incl. (59)	5-H	1
59	PUM30001-81	Spring		5-G	1
60	PU53026	Drive Gear (2)		3-H	1
61	PUM30017-6	Slit Washer		3-H	1
62	–	–		–	–
63	PU53028	Loading Arm (L)		4-G	1
64	PU53029	Ring Guide (1)		3-G, 4-G	6
65	PU53030	" (2)		5-G	3
66	PUM30017-6	Slit Washer		5-G	3
67	PU53031A	P. Roller Cam Assembly		5-E	1
68	REE4000	E-Ring		5-E	1
69	PUM30005-11	Collar		5-E	1
70	PU33551-2	Cam Gear		5-E	1
71	PUM30017-6	Slit Washer		5-E	1
72	PU53036A	Worm Wheel Assembly		5-G	1
73	PUM30017-6	Slit Washer		5-G	1
74	PU53088	Loading Switch		4-F	1
75	SPSP2606Z	Screw		5-F	1
76	–	REEL SENSOR Board Assembly	See Section 8.2.8.	5-C	2
77	SPSP2606Z	Screw		5-C	2
78	PU53819	Switch Bracket		4-C	1
79	SPSP2603Z	Screw		5-C	1
80	PU53083	Solenoid Switch		5-C	1
81	SPSP2608Z	Screw		5-C	1
82	PU53040B	Pole Base Assembly (T.U.)	Incl. (83)	2-F	1
83	YFS2025S	Setscrew		1-F	1
84	PU53044A	Pole Base Assembly (SP.)	Incl. (85)	1-E	1
85	YFS2025S	Setscrew		1-F	1
86	PU53046A	Guide Roller Assembly		1-E	2
87	PU53051	Flange Collar		4-G	2
88	SSSP2606Z	Screw		4-G	2
89	PU53057	F.E.H. Arm Spring		1-B	1
90	PU53053A	F.E.H. Arm Sub Assembly		1-B	1
91	PU54742A	Roller Assembly		1-B	1
92	REE1500	E-Ring		1-B	1
93	PU54397	Full Erase Head		1-B	1
94	–	–		–	–
95	LPSP2005Z	Screw		1-B	2
96	–	F.E. HEAD Board Assembly	See Section 8.2.6.	1-B	1
97	PUM30002-31	Spring		1-B	1
98	PU53058	Guide Pole		1-B	1
99	PU49276	Nylon Nut		1-B	1
100	PU53059A	Head Arm Assembly	Incl. (101)	2-E	1
101	PUM30001-75	Spring		2-E	1
102	WNB4000N	Washer		2-E	1
103	PUM30002-54	Spring		2-E	1
104	REE3000	E-Ring		1-E	1
105	PU53061-2	Rod (1)		1-D	1
106	PU53062	Rod (2)		1-C	1
107	PU53063	Head Base (1)		2-D	1
108	DPSP2606Z	Screw		1-D	2
109	PU53064-2	Head Spring Plate		1-D	1
110	PU54395	A/C Head		1-D	1

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
111	SPSP2606Z	Screw		1-D	3
112	PU49485-3	Wire Clamp		2-D	1
113	SPSP2604Z	Screw		2-E	1
⚠114	PU53066V	Capstan Motor		5-D	1
115	SPSP2606Z	Screw		3-D	3
116	PU54737A	P.R. Arm Sub Assembly		1-F	1
117	PU54739A	Pinch Roller Assembly		1-F	1
118	PU53878	R.P. Cap		1-F	1
119	SPSP2005Z	Screw		1-F	1
120	REE3000	E-Ring		2-F	1
121	REE2500	″		5-E	1
122	PU53076	Door Guide Bracket		4-F	1
123	PU53077A	Guide Arm Assembly		3-F	1
124	LPSP2605Z	Screw		3-F	1
125	PUM30001-92	Spring		4-F	1
126	SPSP2603Z	Screw		4-F	1
127	PU52732	Cassette Switch		4-F	1
128	SPSP2608Z	Screw		4-F	1
129	PU53085A	REC. Bracket Assembly		5-B	1
130	PU53087	REC. Safety Lever		4-B	1
131	PUM30017-3	Slit Washer		4-B	1
132	SSSP2604Z	Screw		5-B	1
133	PU53083	REC. Safety Switch		4-B	1
134	SPSP2608Z	Screw		4-B	1
⚠135	PU53037A	Loading Gear Assembly		3-B	1
136	PU53038	Drive Gear Bracket		3-A	1
137	PU53212	Shaft		3-A	1
138	PU53213A	Worm Gear		3-B	1
139	PUM30017	Slit Washer		3-A, 3-B	2
⚠140	PU53039V	Loading Motor		3-A	1
141	SPSP2003Z	Screw		3-A	2
142	PU53214	L. Motor Pulley		3-B	1
143	YFS2603	Setscrew		3-A	1
144	PUM30003-6	Loading Belt		3-B	1
145	LPSP2606Z	Screw		4-A	2
146	PU53091	Dew Sensor		1-C	1
147	SPSP2603Z	Screw		1-C	1
148	–	END SENSOR Board Assembly	See Section 8.2.10.	1-A	1
149	PU48973-3	Stopper		1-A	1
150	–	LED Board Assembly	See Section 8.2.11.	3-F	1
151	SSSP2606Z	Screw		3-F	1
152	PU53092	Brush		3-F	1
153	SPSP2604Z	Screw		3-F	1
154	PU21407A	Supporter Assembly (1)		2-A	1
155	SWSP2606Z	Screw		2-A	2
156	SSSP2606Z	″		2-A	1
157	PU33575	Supporter (2)		5-F	1
158	SSSP2606Z	Screw		5-F	1
159	PU53281A	Supporter Assembly (3)		1-A	1
160	SWSP2606Z	Screw		1-A	1
161	SSSP2606Z	″		2-B, 1-A	2
162	PU33577-1-2	Supporter (4)		2-G	1
163	SWSP2606Z	Screw		2-G	1
164	SSSP2606Z	″		2-H	2
165	–	JUNCTION Board Assembly	See Section 8.2.7.	3-B	1
166	SBSA2608Z	Tapping Screw		4-B	2
167	–	Drum Assembly	See Section 7.3.4.	1-G	1
168	LPSP2606Z	Screw		1-G	3
169	PU54044	Wire Holder		4-E	1
170	SPSP2604Z	Screw		4-E	1
171	PU54262	Tape Guide (B)		2-E	2
172	Q03093-127	Washer		2-E	1
173	PU54198A	Tension Brake Assembly	Incl. (174)	3-E	1
174	PUM30001-71	Spring		3-E	1
175	PU54243	Cap		3-E	1
176	Q03093-834	Washer		2-D	1
177	PUM30005-24	Collar		1-F	1

7.3.4 Drum assembly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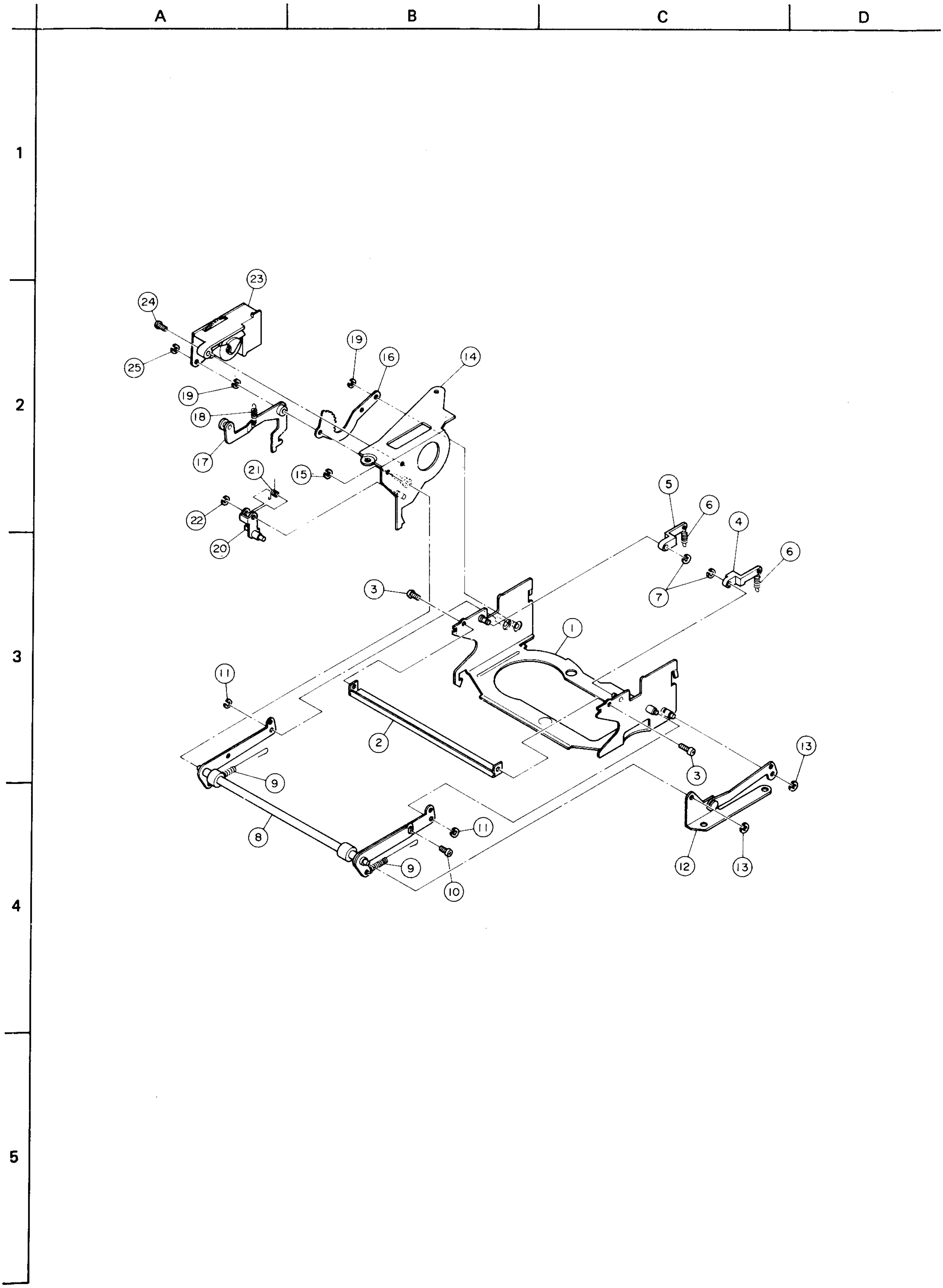
– Drum assembly list –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
⚠ 1	PUS26539B	Lower Drum Assembly		3-B	1
2	PU53162	P.U. Head		4-B	1
3	SPBP1704N	Screw		4-B	1
4	–	PRE AMP Board Assembly	See Section 8.2.3.	3-B	1
5	PU53321	Shield Case		3-C	1
6	LPSP2006	Screw		2-D	2
7	PU33620B	Upper Drum Assembly		2-B	1
8	NDBP2608N	Screw		1-B	2
9	PU54741	Shield Plate		2-D	1
10	PU54349	Plate		3-B	1
11	LPSP2606Z	Screw		3-B	1

7.3.5 Cassette housing assembly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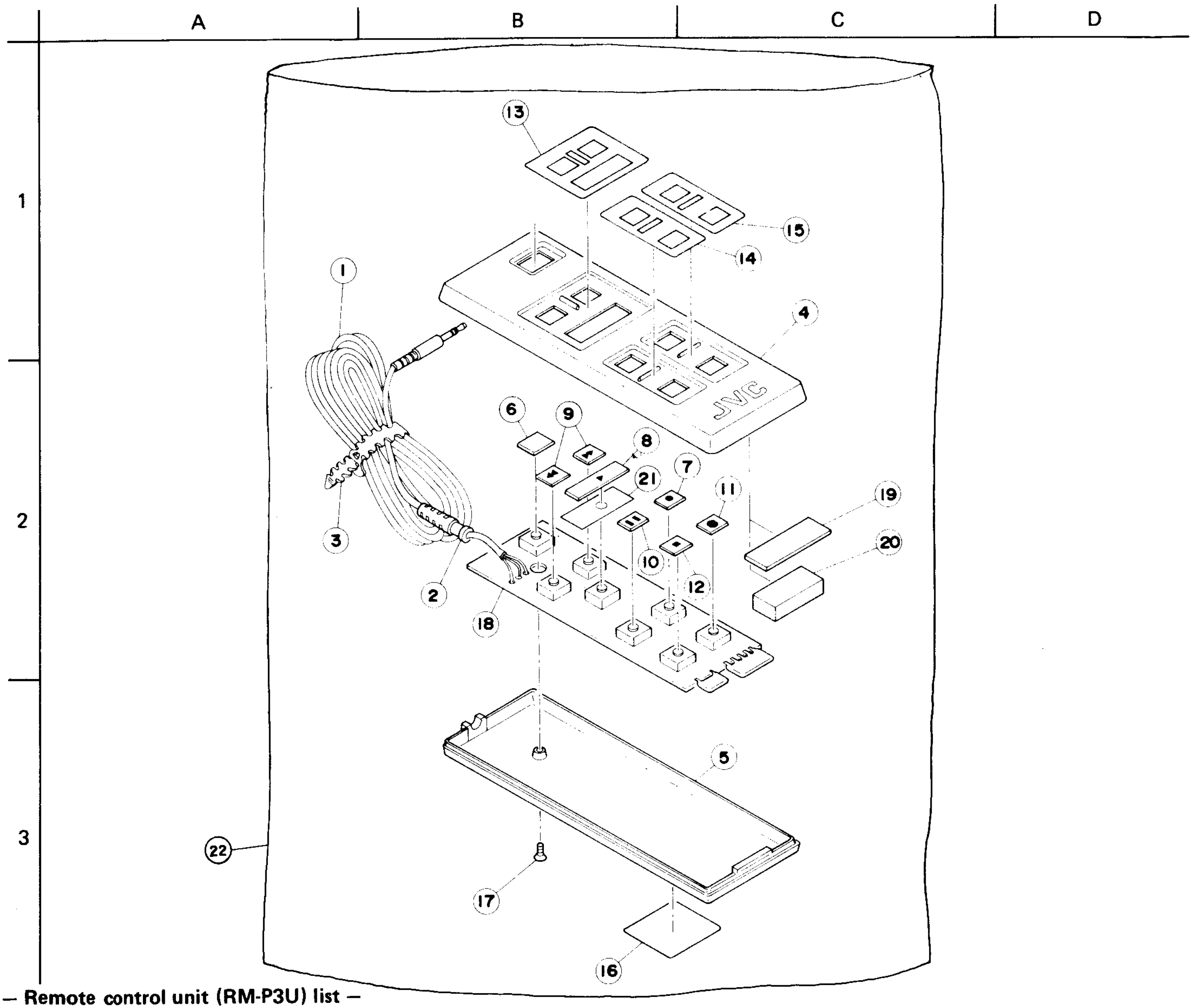
– Cassette housing assembly list – PUS26487A

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	PU33553A	Cassette Holder Assembly		3-C	1
2	PU53094	C. Holder Stay		3-B	1
3	SPSP2003M	Screw		3-B, 3-C	2
4	PU53095-2	Push Arm (R)		2-C	1
5	PU53096-2	Push Arm (L)		2-C	1
6	PUM30001-77	Spring		2-C, 3-D	2
7	REE1500	"E" Ring		3-C	2
8	PU53097B	Holder Shaft Assembly	Incl. (9)	4-A	1
9	PU53322-2	Spring		4-B, 3-A	2
10	SPSP2604Z	Screw		4-B	1
11	REE2500	"E" Ring		3-A, 4-B	2
12	PU53103A	Holder Bracket Assembly (R)		4-C	1
13	REE2500	"E" Ring		3-D, 4-C	2
14	PU53107A	Holder Bracket Assembly (L)		2-B	1
15	REE2500	"E" Ring		2-B	1
16	PU53505	C. Holder Arm (L)		2-B	1
17	PU53109A	Eject Arm Assembly (1)	Incl. (18)	2-A	1
18	PUM30001-69	Spring		2-A	1
19	REE2500	"E" Ring		2-A, 2-B	2
20	PU53112A	Eject Arm Ass'y (2)		3-A	1
21	PU53115	Spring		2-A	1
22	REE2500	"E" Ring		2-A	1
23	PU53245	Damper		1-A	1
24	DPSP2610Z	Screw		2-A	1
25	REE2500	"E" Ring		2-A	1

7.3.6 Remote control unit (RM-P3U)



– Remote control unit (RM-P3U) list –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
⚠ 1	PU33697-100	Cord Ass'y		1-A	1
2	" -101	Bushing		2-B	1
3	" -120	Band		2-A	1
4	" -102	Upper Case Ass'y	Incl. (13), (14), (15)	1-C	1
5	" -107	Under Case Ass'y	Incl. (16)	3-C	1
6	" -110	POWER BUTTON	(BLUE)	2-B	1
7	" -111	REC "	(ORANGE)	2-C	1
8	" -112	PLAY "	(GRAY)	2-B	1
9	" -113	FF, REW "	(")	2-B	2
10	" -114	PAUSE "	(")	2-B	1
11	" -115	A. DUB "	(")	2-C	1
12	" -116	STOP "	(")	2-C	1
13	" -104	Top Panel (U)		1-B	1
14	" -106	" " (L)		1-C	1
15	" -105	Top Panel (R)		1-C	1
16	" -109	Label		3-B	1
17	" -123	Screw		3-B	1
18	" -121	Remote Control P.W.B Ass'y	See Section 8.2.13.	2-B	1
19	" -117	Weight		2-C	1
20	" -118	Separater		2-C	1
21	" -119	Insulator Sheet		2-B	1
22	" -124	Poly Bag		3-A	1

SECTION 8
ELECTRICAL PARTS LIST

SAFETY PRECAUTION

Parts identified by the ⚠ symbol are critical for safety. Replace only with specified part numbers.

ABBREVIATIONS IN THIS LIST ARE AS FOLLOWS:

RESISTORS – All resistance values are in ohms (Ω).

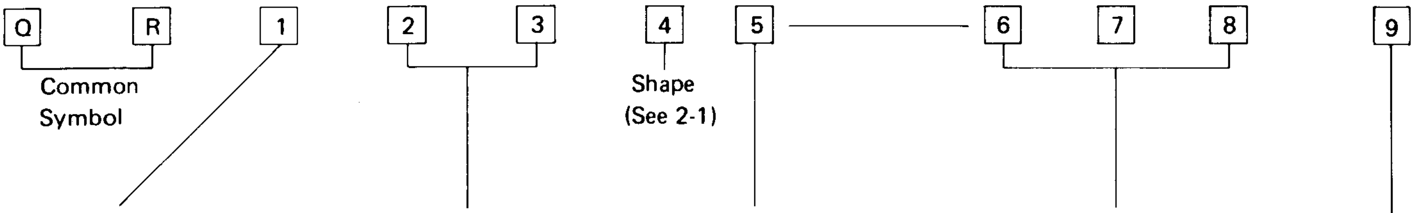
K : 1 000
M : 1 000 000
CR : Carbon Resistor
Comp. R: Composition Resistor
WR : Wire Wound Resistor
OMR : Oxide Metal Film Resistor
VR : Variable Resistor (Potentiometer)
MFR : Metal Film Resistor
FR : Fusible Resistor
PMR : Precision Metal Film Resistor

CAPACITORS – All capacitance values are in μF, unless otherwise indicated.

P : μμF
C Cap : Ceramic Capacitor
E Cap : Electrolytic Capacitor
FM Cap : Film Mica Capacitor
MM Cap : Metalized Mylar Capacitor
MP Cap : Metalized Paper Capacitor
MY Cap : Mylar Capacitor
NP Cap : Non-polar Capacitor
PC Cap : Polycarbonate Capacitor
PP Cap : Poly Pro Capacitor
PS Cap : Polystyrol Capacitor
T Cap : Tantalum Capacitor
TR Cap : Trimmer Capacitor
LL Cap : Low Leak Current Electrolytic Capacitor
TF Cap : Thin Film Capacitor

8.1 STANDARD PART NUMBER CODING

8.1.1 Fixed Resistor Coding



Type of resistor

C	Composition Resistor
D	Carbon Resistor
F	Unflammable Resistor
G	Oxide Metal Film Resistor
M	Metal Plate Resistor
X	Metal Film Resistor
W	Wire Wound Resistor
Y	Wire Wound Resistor
V	Metal Film Resistor, High Stability
Z	Special Resistor
S	Chip Resistor

Rated Wattage

Symbol	Rated wattage
16	1/6 (W)
18	1/8 "
14	1/4 "
12	1/2 "
01	1 "
02	2 "
03	3 "
04	4 "
05	5 "
06	6 "
07	7 "
75	7.5 "
08	8 "
10	10 "
15	15 "
20	20 "
30	30 "

Tolerance

Symbol	Tolerance
F	±1 %
G	±2 %
J	±5 %
K	±10 %
M	±20 %

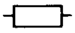
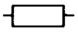
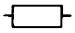
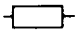
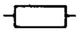
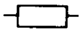
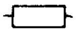
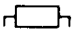
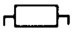
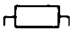
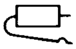
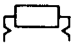
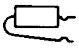
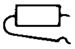
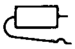
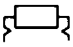
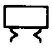
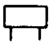
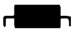
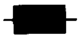
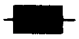
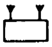
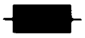
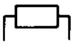
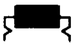
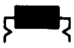
Values

–Example –		
R47	....	0.47 Ω
4R7	....	4.7 Ω
470	..... 47×10^0	47 Ω
471	..... 47×10^1	470Ω
472	..... 47×10^2	4.7 KΩ
473	..... 47×10^3	47 KΩ
474	..... 47×10^4	470 KΩ
475	..... 47×10^5	4.7 MΩ
10R2	....	10.2 Ω
1430	... 143×10^0	143 Ω
1581	... 158×10^1	1.58 KΩ

Size

Symbol	Size
A	Small Size
S	Small Size

2-1 Shape of resistor (■ : Flame retardant resistor)

Sort	C	D	G	F	M	W	X	Y	V
1									
2									
3									
4									
5						L type			
6						Resin Covered			
7						Enameled			
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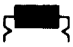
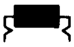
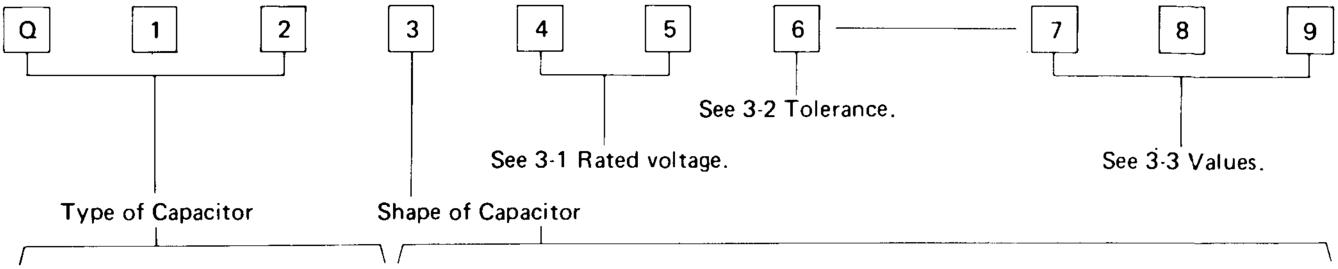
9									

8.1.2 Fixed Capacitor Coding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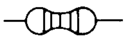
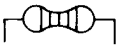
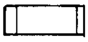
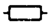
See 3-2 Tolerance.
See 3-1 Rated voltage.
See 3-3 Values.
Type of Capacitor
Shape of Capacitor

Ceramic Capacitors

Symbol	Type of Capacitor	Disk Lead	Kink Lead			
QCF	Ceramic	1	3			
QCS	"	1	3			
QCY	"	1, 4	3			8
QCT	Temperature compensation					
QCZ	Special					
QCX	"			1	3	

Electrolytic Capacitors

Symbol	Type of Capacitor	Tubular 	Mono-direction	Anti-stress	Forming	Snap-in
QEA	Characteristic A	2	4			
QED	Characteristic D	2	4			
QEE	Tantalum		4	5		
QEE	" (small type)		8			
QEN	Non-polar	2	4	5	6	
QEW	Characterisitc W	2	4	5	6	7
QET	Characteristic W (small type)	2	4	5	6	
QEK	Characteristic W (subminiature type)		4	5		
QEZ	Special					

Paper Film Capacitors

Symbol	Type of Capacitor	Tubular	Normal		Flame retardant	
			Mono-direction	Kink Lead	Mono-direction	Kink Lead
QFF	Film mica		4			
QFH	Metalized mylar	2	4	3	5	6
QFM	Mylar	2	4	3, 7	5	6
QFN	" (small type)		4			
QFP	Polypropylene		4	3		
QFS	Polystyrole	2	4	3		
QFZ	Special					

1) Rated voltage (V)

2nd letter / First letter	A	B	C	D	E	F	G	H	J	K	V	W	X
0						3.15			6.3				
1	10		16	20	25		40	50	63		35		
2	100	125	160	200	250	315	400	500	630		350	450	600
3	1000	1250		2000				5000					

2) Tolerance

Symbol	F	G	J	K	M	Z	P	A	H	R
(%)	± 1	± 2	± 5	± 10	± 20	+ 80 − 20	+ 100 − 0	+ 100 − 10	+ 50 − 10	+ 30 − 10

3) Values

– Example – Values are in picofarads.

101 ..... 10×10^1 ..... 100 pF

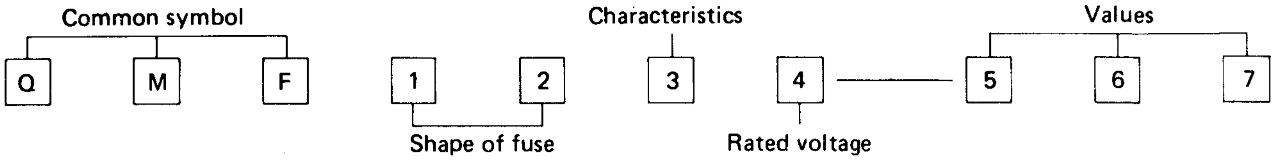
102 ..... 10×10^2 ..... 1,000 pF

103 ..... 10×10^3 ..... 10,000 pF = 0.01 μF

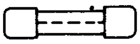
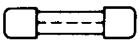
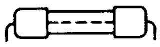
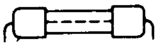
104 ..... 10×10^4 ..... 100,000 pF = 0.1 μF

5R0 ..... 5.0 ..... 5 pF

8.1.3 Fuse Coding



Shape of Fuse (first and second digit)

Symbol No.	Shape	Remarks
51		ϕ 5.2 x 20
60		ϕ 6.4 x 30
61		ϕ 6.35 x 31.8
63		With 60 Lead Wire
66		With 61 Lead Wire

Rated Voltage (fourth digit)

Symbol No.	Rated Voltage
1	AC 125 V
2	AC 250 V

Value (fifth – seventh digit)

– Example –

R10	0.1 A
R125	0.125 A
1R0	1.0 A
1R2	1.2 A
1R25	1.25 A
100	10 A

Characteristics (third digit)

Symbol No.	Fusing Current	Fusing Time	Remarks
S	160%	Within 1 hr.	Anti-rush Type
	200%	" 2 min.	
	700% – 2000%	" 0.01 sec.	
R	160%	" 1 hr.	Regular Fusible Type
	200%	" 2 min.	
M	135%	" 1 hr.	Regular Fusible Type (for UL)
	200%	" 2 min.	
U	135%	" 1 hr.	Anti-rush Type (for UL)
	200%	" 2 min.	
	800% – 2000%	" 0.01 sec.	
A	210%	" 2 min.	Anti-rush Type (for Europe)
	275%	0.5 – 10 sec.	
	400%	0.15 – 2 sec.	
	1000%	0.02 – 0.3 sec.	
B	210%	Within 30 min.	Regular Fusible Type (for SEMKO, Europe)
	275%	0.05 – 2 sec.	
	400%	0.01 – 0.3 sec.	

8.2 ELECTRICAL PARTS LIST BY ASSEMBLIES

8.2.1 Servo Board Ass'y 0 1 ..... PU10609A-CM

Symbol No.	Part No.	Part Name	Recommended Part/ Description
IC 1	BAF6303	Integrated Circuit	
IC 2	BAF6305	"	
⚠IC 3	BAF851A	"	
IC 4	UPC451G	"	
IC 5	"	"	
IC 6	BA6324F	"	
IC 7	M54576FP	"	
IC 8	"	"	
IC 9	M54577FP	"	
IC10	"	"	
IC201	NJM78L05A	Integrated Circuit	
IC202	UPC1511G	"	
IC301	BA6322F	Integrated Circuit	
IC302	M54543L	"	
IC303	M54545L	"	
Q 1	–	–	
Q 2	2SB709	Chip Transistor	or 2SA1037K
Q 3	2SB710	"	
Q 4	2SD601	"	or 2SC2412K
Q 5	2SB709	"	or 2SA1037K
Q 6	"	"	
Q 7	2SD601	"	or 2SC2412K
Q 8	2SB709	"	or 2SA1037K
Q 9	2SD602	"	
Q10	"	"	
Q11	2SB709	"	or 2SA1037K
Q12	–	–	
Q201	2SD601	Chip Transistor	or 2SC2412K
Q202	"	"	
Q203	2SB709	"	or 2SA1037K
Q204	"	"	
Q205	"	"	
Q206	"	"	
Q207	2SB798	"	
Q208	"	"	
Q209	"	"	
Q210	"	"	
Q211	2SD999	"	
Q212	"	"	
Q213	"	"	
Q214	"	"	
⚠ Q301	2SD1244Q,R	Transistor	
⚠ Q302	2SD1119	Chip Transistor	
⚠ Q303	2SD1244Q,R	Transistor	
Q304	2SD601 or 2SC2412K	Chip Transistor	
⚠ Q305	2SD1119	"	
Q306	2SB710	"	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
D 1	–	–	
D 2	MA151WK	Chip Diode	or DAN202K
D 3	"	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	"	"	
D 8	MA151WA	"	or DAP202K
D 9	MA151WK	"	or DAN202K
D10	–	–	
D11	MA151WK	Chip Diode	or DAN202K
D12	"	"	
D13	MA151WA	"	or DAP202K
D14	"	"	
D15	"	"	
D16	MA151WK	"	or DAN202K
D17	"	"	
D18	MA151WA	"	or DAP202K
D19	MA151WK	"	or DAN202K
D20	MA151WA	"	or DAP202K
D21	"	"	
D22	MA151WK	"	or DAN202K
D23	"	"	
D24	"	"	
D25	–	–	
D26	MA151WK	Chip Diode	or DAN202K
D27	MA151WA	"	or DAP202K
D28	"	"	
D29	–	–	
D30	–	–	
D31	–	–	
D32	MA151WK	Chip Diode	or DAN202K
D203	MA151WK	Chip Diode	or DAN202K
R 1	QRS188J-823YN	Chip R	
R 2	QVZ3531-683	VR	CAP. SAMPLE POS.
R 3	QRS188J-103YN	Chip R	
R 4	" -473YN	"	
R 5	" -473YN	"	
R 6	" -473YN	"	
R 7	" -102YN	"	
R 8	" -334YN	"	
R 9	" -103YN	"	
R10	" -103YN	"	
R11	" -331YN	"	
R12	" -334YN	"	
R13	" -103YN	"	
R14	" -103YN	"	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
R15	QRS188J-103YN	Chip R	
R16	" -103YN	"	
R17	" -104YN	"	
R18	QVZ3531-474	VR	CH-1 SW PHASE
R19	QRS188J-104YN	Chip R	
R20	QVZ3531-474	VR	CH-2 SW PHASE
R21	QRS188J-103YN	Chip R	
R22	" -473YN	"	
R23	" -473YN	"	
R24	" -393YN	"	
R25	" -563YN	"	
R26	" -104YN	"	
R27	QVZ3531-473	VR	REC PHASE
R28	QRS188J-105YN	Chip R	
R29	" -823YN	"	
R30	" -394YN	"	
R31	–	–	
R32	QRS188J-474YN	Chip R	
R33	" -153YN	"	
R34	" -154YN	"	
R35	" -273YN	"	
R36	QVZ3531-224	VR	PRE SET
R37	QRS188J-333YN	Chip R	
R38	PU51884-2	VR	TRACKING
R39	QRS188J-274YN	Chip R	
R40	" -223YN	"	
R41	" -104YN	"	
R42	" -334YN	"	
R43	" -0R0Y	"	
R44	" -103YN	"	
R45	" -103YN	"	
R46	" -103YN	"	
R47	" -474YN	"	
R48	" -104YN	"	
R49	" -473YN	"	
R50	QVZ3531-105	VR	SEARCH FF PHASE
R51	QRS188J-103YN	Chip R	
R52	" -224YN	"	
R53	" -183YN	"	
R54	" -683YN	"	
R55	" -103YN	"	
R56	" -103YN	"	
R57	" -103YN	"	
R58	" -102YN	"	
R59	" -102YN	"	
R60	" -104YN	"	
R61	" -563YN	"	
R62	" -104YN	"	
R63	" -683YN	"	
R64	" -105YN	"	
R65	" -224YN	"	
R66	" -391YN	"	
R67	" -224YN	"	
R68	" -103YN	"	
R69	" -474YN	"	
R70	" -105YN	"	
R71	" -473YN	"	
R72	" -223YN	"	
R73	" -154YN	"	
R74	QVZ3531-223	VR	DRUM PULSE LEV.
R75	QRS188J-564YN	Chip R	
R76	" -473YN	"	
R77	" -473YN	"	
R78	" -223YN	"	
R79	" -473YN	"	
R80	QRS188J-473YN	Chip R	
R81	" -473YN	"	
R82	" -473YN	"	
R83	" -473YN	"	
R84	" -103YN	"	
R85	" -473YN	"	
R86	" -472YN	"	
R87	" -472YN	"	
R88	" -332YN	"	
R89	" -333YN	"	
R90	–	–	
R91	QRS188J-123YN	Chip R	
R92	" -473YN	"	
R93	" -472YN	"	
R94	" -153YN	"	
R95	–	–	
R96	QRS188J-562YN	Chip R	
R97	" -222YN	"	
R98	" -104YN	"	
R99	" -564YN	"	
R100	" -473YN	"	
R101	" -103YN	"	
R102	" -102YN	"	
R103	" -102YN	"	
R104	" -101YN	"	
R105	" -100YN	"	
R106	" -0R0Y	"	
R107	" -103YN	"	
R108	" -103YN	"	
R109	" -181YN	"	
R110	" -473YN	"	
R111	" -152YN	"	
R112	" -154YN	"	
R113	" -103YN	"	
R114	" -221YN	"	
R115	" -821YN	"	
R116	" -473YN	"	
R117	" -103YN	"	
R118	" -152YN	"	
R119	" -154YN	"	
R120	" -103YN	"	
R121	" -102YN	"	
R122	" -471YN	"	
⚠ R123	QRZ0054-100	FR	
R124	QRS188J-472YN	Chip R	
R125	" -223YN	"	
R126	" -102YN	"	
R127	" -471YN	"	
R128	" -680YN	"	
R129	" -6R8YN	"	
R130	" -561YN	"	
R131	" -561YN	"	
R132	" -681YN	"	
R133	" -102YN	"	
R134	–	–	
R135	QRS188J-473YN	Chip R	
R136	" -472YN	"	
R137	" -333YN	"	
R138	" -223YN	"	
R139	" -103YN	"	
R140	" -0R0Y	"	
R141	" -0R0Y	"	
R142	–	–	
R143	–	–	
R144	–	–	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
R145	—	—	
R146	—	—	
R147	—	—	
R148	QRS188J-473YN	Chip R	
R149	" -563YN	"	
R150	—	—	
R151	QRS188J-0R0Y	Chip R	
R152	" -104YN	"	
R153	" -102YN	"	
R154	" -222YN	"	
R155	" -0R0Y	"	
R156	—	—	
R157	—	—	
R158	QRS188J-0R0Y	Chip R	
⚠ R201	PU54443	Posistor	
R202	QRS188J-472YN	Chip R	
R203	" -473YN	"	
R204	—	—	
R205	QRS188J-103YN	Chip R	
R206	QVZ3531-473	VR	DRUM F/V
R207	QRS188J-823YN	Chip R	
R208	—	—	
R209	QRS188J-222YN	Chip R	
R210	" -105YN	"	
R211	" -274YN	"	
R212	" -273YN	"	
R213	" -154YN	"	
R214	" -151YN	"	
R215	" -471YN	"	
R216	" -471YN	"	
R217	" -471YN	"	
R218	" -471YN	"	
⚠ R219	QRX019J-R68S	MFR	
R220	QRS188J-333YN	Chip R	
R221	" -333YN	"	
R222	" -333YN	"	
R223	" -333YN	"	
R224	" -471YN	"	
R225	" -471YN	"	
R226	" -471YN	"	
R227	" -471YN	"	
R228	" -103YN	"	
R301	QRS188J-220YN	Chip R	
R302	" -564YN	"	
R303	" -223YN	"	
R304	" -220YN	"	
R305	" -332YN	"	
R306	" -223YN	"	
R307	" -472YN	"	
C 1	QFN41HJ-473	MY Cap	
C 2	QCY81HK-103	Chip Cap	
C 3	QFZ9011-184	MY Cap	
C 4	QEK61HM-105	E Cap	
C 5	QCY81HK-102	Chip Cap	
C 6	" -223	"	
C 7	QEK60JM-476	E Cap	
C 8	QCY81HK-102	Chip Cap	
C 9	QEK61CM-106	E Cap	
C10	QCY81HK-103	Chip Cap	
C11	" -103	"	
C12	PU53610J-682	MY Cap	
C13	" -682	"	
C14	QCY81HK-103	Chip Cap	
C15	" -103	"	
C16	" -103	"	
C17	" -103	"	
C18	QFN41HJ-473	MY Cap	
C19	QCY81HK-333	Chip Cap	
C20	QCS81HK-391	"	
C21	QFN41HJ-473	MY Cap	
C22	QCY81HK-472	Chip Cap	
C23	" -102	"	
C24	" -103	"	
C25	QFN41HJ-104	MY Cap	
C26	QEK51CM-106G	E Cap	
C27	QCY81HK-103	Chip Cap	
C28	QFN41HJ-104	MY Cap	
C29	QFZ9011-124	"	
C30	QFN41HJ-104	"	
C31	QCY81EK-333	Chip Cap	
C32	QCS81HK-391	"	
C33	QCY81HK-102	"	
C34	QFN41HJ-104	MY Cap	
C35	QCY81HK-103	Chip Cap	
C36	" -103	"	
C37	QEK61CM-106	E Cap	
C38	QFZ9011-104	"	
C39	" -104	"	
C40	QEL61EM-475	"	
C41	" -475	"	
C42	" -475	"	
C43	" -475	"	
C44	QEK61CM-106	"	
C45	QCY81EK-273	Chip Cap	
C46	QCY81HK-102	"	
C47	QEK61CM-106	E Cap	
C48	QCY81HK-183	Chip Cap	
C49	" -103	"	
C50	" -103	"	
C51	—	—	
C52	QEK51CM-106G	E Cap	
C53	QEK61CM-476	"	
C54	QEK61EM-335	"	
C55	QCY81HK-223	Chip Cap	
C56	QEK61EM-335	E Cap	
C57	QCY81HK-153	Chip Cap	
C58	" -102	"	
C59	QCS81HK-821	"	
C201	QCF81EZ-104	Chip Cap	
C202	QCY81HK-103	"	
C203	—	—	
C204	QCY81HK-562	Chip Cap	
C205	PU54820J-103	PP Cap	
C206	QCY81HK-103	Chip Cap	
C207	—	—	
C208	—	—	
C209	QCF81EZ-104	Chip Cap	
C210	QCS81HK-221	"	
C211	QCY81EK-473	"	
C212	" -473	"	
C213	" -473	"	
C214	" -473	"	
C215	QCF81EZ-104	"	
C216	" -104	"	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
C301	QEK61HM-105	E Cap	
C302	QCF81EZ-104	Chip Cap	
C303	" -104	"	
C304	" -104	"	
C305	" -104	"	
C306	" -104	"	
⚠ RY 1	PU54422	Relay	
	PU54434	Connector Ass'y	
SW 1	PU51812-2	Slide Switch	
	PU53460	Test Pin	TP1–3, 5–8, 11–14
	"	"	TP201–203
	"	"	TP301
⚠ X 1	PU47701	Crystal	
VA 1	PU49624	Varistor	
⚠	PU51212	Fuse Clip	F1, F2, F3
CN 1	PU50355-8	Housing	Video
CN 2	" -14	"	"
CN 3	" -12	"	SW Reg.
CN 4	" -10	"	Audio
CN 5	" -20	"	M. CTL
CN 6	" -22	"	"
CN 7	PU53604-12	"	J. PWB
CN 8	" -28	"	"

Fuses not included in PU10609A-CM

Symbol No.	Part No.	Part Name	Recommended Part/ Description
⚠ F 1	QMF51A2-3R15	Fuse	T 3.15 A
⚠ F 2	" -R63	"	T 0.63 A
⚠ F 3	" -R63	"	T 0.63 A

8.2.2 Y/C Board Ass'y 0 2 .... PU21537A-4-M

Symbol No.	Part No.	Part Name	Recommended Part/ Description
IC 1	MC5339	Integrated Circuit	
⚠ IC 2	MC5408	"	
IC 3	MC5407	"	
IC 4	MC5338	"	
IC 5	MC5406	"	
IC 6	MC5409	"	
⚠ IC 7	MCM1020	"	
IC 8	MC5378B	"	
IC 9	MC5336B	"	
IC10	MC5365	"	
IC11	–	–	
⚠ IC12	MC5405B	Integrated Circuit	
Q 1	2SC2787LF	Transistor	
Q 2	2SC2785HF,FF,EF	"	
Q 3	2SA881	"	
Q 4	2SC2787LF	"	
Q 5	"	"	
Q 6	"	"	
Q 7	"	"	
Q 8	2SA1175	"	
Q 9	DTC124N	D Transistor	
D 1	1SS133	Diode	
D 2	"	"	
D 3	"	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	"	"	
R 1	QRD161J-391	CR	
R 2	" -820	"	
R 3	" -562	"	
R 4	QVZ3531-681	VR	DARK CLIP
R 5	QRD161J-682	CR	
R 6	QVZ3531-102	VR	WHITE CLIP
R 7	" -102	"	
R 8	QRD161J-122	CR	
⚠ R 9	ERTD2FHL-332S	Thermistor	
R10	QRD161J-181	CR	
R11	" -103	"	
R12	" -102	"	
R13	QVZ3531-471	VR	REC FM LEVEL
R14	QRD161J-222	CR	
R15	" -222	"	
R16	" -223	"	
R17	" -333	"	
R18	" -102	"	
R19	" -102	"	
R20	" -221	"	
R21	" -471	"	
R22	" -681	"	
R23	" -102	"	
R24	" -222	"	
R25	QVZ3531-222	VR	PB Y LEVEL
R26	QRD161J-102	CR	
R27	" -103	"	
R28	" -152	"	
R29	QVZ3531-331	VR	NOISE CANCEL

Symbol No.	Part No.	Part Name	Recommended Part/ Description
R30	QRD161J-331	CR	
R31	″ -221	″	
R32	QVZ3531-471	VR	E-E LEVEL
R33	QRD161J-392	CR	
R34	″ -333	″	
R35	″ -750	″	
R36	″ -152	″	
R37	QVZ3531-222	VR	DEVIATION
R38	QRD161J-562	CR	
R39	″ -564	″	
R40	″ -391	″	
R41	″ -471	″	
R42	″ -333	″	
R43	″ -393	″	
R44	″ -332	″	
R45	″ -331	″	
R46	QVZ3531-681	VR	RF EQ
R47	—	—	
R48	QRD161J-681	CR	
R49	″ -102	″	
R50	″ -820	″	
R51	″ -333	″	
R52	″ -562	″	
R53	″ -682	″	
R54	″ -333	″	
R55	QRD167J-564	″	
R56	QRD161J-123	″	
R57	QVZ3531-103	VR	CONV. BALANCE
R58	QRD161J-682	CR	
R59	″ -152	″	
R60	″ -152	″	
R61	—	—	
R62	QRD161J-102	CR	
R63	″ -102	″	
R64	″ -152	″	
R65	—	—	
R66	—	—	
R67	—	—	
R68	—	—	
R69	—	—	
R70	—	—	
R71	—	—	
R72	—	—	
R73	—	—	
R74	—	—	
R75	—	—	
R76	QRD161J-332	CR	
R77	″ -184	″	
R78	—	—	
R79	—	—	
R80	—	—	
R81	—	—	
R82	—	—	
R83	—	—	
R84	—	—	
R85	—	—	
R86	—	—	
R87	QVZ3531-223	VR	VXO
R88	″ -472	″	AFC
R89	QRD161J-102	CR	
R90	QVZ3531-222	VR	REC COL. LEVEL
R91	QRD161J-102	CR	
R92	″ -102	″	
R93	″ -101	″	
R94	″ -472	″	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
R95	—	—	
R96	—	—	
R97	QRD161J-154	CR	
R98	—	—	
R99	—	—	
R100	QRD141J-151	CR	
R101	QRD161J-122	″	
R102	″ -392	″	
R103	″ -122	″	
R104	″ -681	″	
R105	″ -684	″	
⚠ R106	PU52108-2R2	Posistor	
⚠ R107	QRD161J-100	CR	
R108	″ -561	″	
R109	QRD161J-152	″	
C 1	QER60JM-107	E Cap	
C 2	—	—	
C 3	PU54775-3	NP Cap	
C 4	PU54775-2	″	
C 5	—	—	
C 6	QER61CM-476	E Cap	
C 7	PU53610J-153	MY Cap	
C 8	PU51163-511	C Cap	
C 9	QER61CM-476	E Cap	
C10	PU53610J-103	MY Cap	
C11	QER51CM-476	E Cap	
C12	QCS31HJ-471	C Cap	
C13	—	—	
C14	QCF31HP-223	C Cap	
C15	QER51CM-476	E Cap	
C16	QER61AM-336	″	
C17	PU54070-2	″	
C18	PU54071	″	
C19	QER51EM-475	″	
C20	QFK51CM-476	″	
C21	PU51163-161	C Cap	
C22	″ -161	″	
C23	QCS31HJ-150	″	
C24	QEK61AM-226	E Cap	
C25	QCS31HJ-121	C Cap	
C26	QER60JM-476	E Cap	
C27	QER61EM-475	″	
C28	—	—	
C29	QER61CM-106	E Cap	
C30	—	—	
C31	QER60JM-107	E Cap	
C32	QER61CM-226	″	
C33	PU54775-3	″	
C34	QER61CM-476	″	
C35	QER60JM-476	″	
C36	—	—	
C37	—	—	
C38	PU53610J-103	MY Cap	
C39	″ -822	″	
C40	″ -103	″	
C41	QER61CM-476	E Cap	
C42	—	—	
C43	PU53610J-103	MY Cap	
C44	PU54070-2	E Cap	
C45	—	—	
C46	QEK61CM-476	E Cap	
C47	QCF31HP-223	C Cap	
C48	QEU50JM-108	E Cap	
C49	QEK61AM-336	″	
C50	—	—	
C51	QCF11HP-223	C Cap	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
C52	QCF11HP-223	C Cap	
C53	–	–	
C54	–	–	
C55	–	–	
C56	PU53610J-472	MY Cap	
C57	〃 -103	〃	
C58	–	–	
C59	–	–	
C60	–	–	
C61	–	–	
C62	–	–	
C63	–	–	
C64	QCS31HJ-220	C Cap	
C65	–	–	
C66	–	–	
C67	QCS31HJ-220	C Cap	
C68	–	–	
C69	–	–	
C70	QER60JM-107	E Cap	
C71	PU54775-3	NP Cap	
C72	QCS31HJ-470	C Cap	
C73	–	–	
C74	QER60JM-336	E Cap	
C75	QCS31HJ-3R0	C Cap	
C76	〃 -180	〃	
C77	〃 -560	〃	
C78	PU53610J-153	MY Cap	
C79	〃 -153	〃	
C80	〃 -103	〃	
C81	QER51CM-476	E Cap	
C82	QER61HM-335	〃	
C83	QER61CM-106	〃	
C84	PU54775-1	NP Cap	
C85	QER60JM-476	〃	
C86	QCS31HJ-330	C Cap	
C87	QER60JM-107	E Cap	
C88	QER51HM-105	〃	
C89	〃 -105	〃	
C90	〃 -225	〃	
L 1	PU53223-101	P. Coil	
L 2	〃 -150	〃	
L 3	〃 -101	〃	
L 4	〃 -101	〃	
L 5	〃 -101	〃	
L 6	–	–	
L 7	–	–	
L 8	PU53223-101	P. Coil	
⚠ L 9	PU53618-101	〃	
⚠ L10	PU53223-101	〃	
L11	〃 -101	〃	
⚠ L12	〃 -101	〃	
⚠ L13	〃 -101	〃	
L14	PU54710-821	〃	
L15	PU53223-101	〃	
⚠ L16	〃 -101	〃	
⚠ L17	〃 -101	〃	
L18	〃 -101	〃	
L19	–	–	
L20	PU54710-222	P. Coil	
L21	–	–	
L22	–	–	
L23	–	–	
L24	PU53223-330	P. Coil	
L25	〃 -150	〃	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
L26	–	–	
L27	PU53223-121	P. Coil	
⚠ L28	〃 -101	〃	
L29	〃 -330	〃	
L30	〃 -271	〃	
LPF 1	PU54405	L.P.F.	
LPF 2	〃	〃	
LPF 3	–	–	
LPF 4	PU54408	L.P.F.	
BPF 1	PU54409	B.P.F.	
BPF 2	PU54410	〃	
DL 1	PU54398M	Delay Line	
EQ 1	PU54400	Equalizer	
EQ 2	PU54401	〃	
EQ 3	PU54402	〃	
EQ 4	–	–	
EQ 5	PU54404	Equalizer	
EQ 6	PU54838	〃	
⚠ X 1	PU54431	Crystal Block	
⚠	PU54432	RF Converter	
	PU54440	Switch	
CN 1	PU50356-8	Cap Housing	
CN 2	〃 -14	〃	
	PU53238	IC Socket	(2.54 mm pitch)
	PU53239	〃	(1.8 mm pitch)
	PU53460	Test Point	TP1, 2, 4, 5, 6, 9–12, 20, 32, 33, 34, 36, 41, 42
	PU53173	Supporter	
	PU53174-1-2	Terminal	
	〃 -2-2	〃	
	SSSP2608Z	Screw	
	WLS2600N	Lock Washer	
	NNS2600N	Nut	

8.2.3 Pre-amp. Board Ass'y 0 3 .... PU33951A-1-C

Symbol No.	Part No.	Part Name	Recommended Part/ Description
IC 1	MC5410	Integrated Circuit	
Q 1	2SC2716Y	Chip Transistor	
Q 2	2SC2757T32	"	
Q 3	"	"	
Q 4	2SC2716Y	"	
Q 5	"	"	
R 1	QRS188J-100YN	Chip R	
R 2	" -100YN	"	
R 3	" -272YN	"	
R 4	" -272YN	"	
R 5	" -331YN	"	
R 6	" -0R0Y	"	
R 7	" -272YN	"	
R 8	QVZ3604-101	VR	CH-2 Q
R 9	" -101	"	CH-1 Q
R10	QRS188J-331YN	Chip R	
R11	" -331YN	"	
R12	" -223YN	"	
B 1	QRS188J-0R0Y	Chip R	
B 2	" -0R0Y	"	
B 3	" -0R0Y	"	
B 4	" -0R0Y	"	
C 1	QEK51HM-105MG	E Cap	
C 2	–	–	
C 3	QCY81EK-223	Chip Cap	
C 4	" -223	"	
C 5	QCS81HJ-150	"	
C 6	" -150	"	
C 7	QAT3001-044	T Cap	CH-1 fo
C 8	" -044	"	CH-2 fo
C 9	QEK51CM-476	E Cap	
C10	" -476	"	
⚠ L 1	PU53223-101G	Coil	
	PU54741	Shield Plate	
	PU53320	Shield Case	
	PU53587-8	Cap Housing	

8.2.4 Audio Board Ass'y 0 4 .... PU21411B-1-M

Symbol No.	Part No.	Part Name	Recommended Part/ Description
IC 1	AN6394	Integrated Circuit	
⚠ IC 2	3VT01	"	
IC 3	5VT04	"	
Q 1	2SB788S,T,U	Transistor	
⚠ Q 2	2SC2647C	"	
D 1	1SS133	Diode	
R 1	QVZ3531-333	VR	E-E LEVEL
R 2	QRD161J-332	CR	
R 3	–	–	
R 4	QVZ3531-103	VR	REC LEVEL
R 5	QRD161J-562	CR	
R 6	" -222	"	
R 7	" -333	"	
R 8	" -222	"	
R 9	" -822	"	
R10	" -103	"	
R11	" -223	"	
R12	" -271	"	
R13	" -124	"	
R14	" -472	"	
R15	QVZ3531-333	VR	PB LEVEL
R16	QRD161J-151	CR	
R17	" -103	"	
⚠ R18	" -272	"	
R19	" -100	"	
R20	" -273	"	
R21	QVZ3531-333	VR	BIAS LEVEL
R22	QRD161J-103	CR	
R23	" -103	"	
R24	" -332	"	
R25	" -153	"	
R26	" -105	"	
R27	" -224	"	
R28	QVZ3531-225	VR	CANCEL
R29	QRD161J-103	CR	
C 1	QFN31HK-122	MY Cap	
C 2	QEK60JM-226	E Cap	
C 3	QEK61EM-335	"	
C 4	" -335	"	
C 5	" -335	"	
C 6	QEK61HM-474	"	
C 7	–	–	
C 8	QFN31HJ-562	MY Cap	
C 9	QEK61EM-335	E Cap	
C10	" -335	"	
C11	" -335	"	
C12	QEK61CM-106	"	
C13	" -226	"	
C14	" -106	"	
C15	QEK60JM-226	"	
C16	QEK61AM-336	"	
C17	QEK61CM-106	"	
C18	" -106	"	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
C19	QFN31HJ-223	MY Cap	
C20	QEK61EM-335	E Cap	
C21	QEK61CM-106	"	
C22	QEK61HM-225	"	
C23	" -474	"	
C24	QEK61CM-106	"	
C25	" -106	"	
C26	" -106	"	
C27	QFN31HJ-681	MY Cap	
C28	" -471	"	
C29	QFP42AG-273M	P Cap	
C30	QEK61CM-106	E Cap	
C31	QEK61AM-336	"	
C32	QFN31HJ-823	MY Cap	
C33	" -822	"	
C34	QEK41CM-106	E Cap	
L 1	PU53615	L.P.F.	
L 2	PU53616	EQ Coil	
⚠ L 3	PU53606-102	Coil	
⚠ L 4	PU53617	OSC Coil	
	PU53460	Test Pin	TP12, 13, 15, 16, GND
CN 1	PU49215-3	Cap Housing	
CN 2	" -3Y	"	
CN 3	" -2	"	
CN 4	PU53587-2	"	
CN 5	PU50356-10	"	

8.2.5 Mechanism Control Board Ass'y 0 5 PU21539A-2-C

Symbol No.	Part No.	Part Name	Recommended Part/ Description
⚠ IC 1	HD44820A83	Integrated Circuit	
IC 2	UPC277G	"	
IC 3	UPC177G	"	
IC 4	UPC277G	"	
IC 5	LC4011BM	"	
IC 6	M54576FP	"	
IC 7	"	"	
IC 8	"	"	
Q 1	2SD601Q,R,S	Chip Transistor	
Q 2	"	"	
Q 3	2SB709Q,R,S	"	
D 1	TLUR143-DE	L.E.D.	REC
D 2	"	"	DUB
D 3	"	"	PLAY
D 4	"	"	PAUSE
D 5	"	"	STOP
D 6	"	"	FF
D 7	"	"	REW
D 8	"	"	BATT
D 9	"	"	DEW
D10	"	"	POWER
D11	MA151WA	Chip Diode	
D12	"	"	
D13	MA151WK	"	
D14	MA151WA	"	
D15	10E2	Diode	
D16	MA151WA	Chip Diode	
D17	"	"	
D18	"	"	
D19	MA151WK	"	
D20	"	"	
D21	"	"	
D22	MA151WA	"	
R 1	QRD163J-103	CR	
R 2	" -103	"	
R 3	—	—	
R 4	QRD188J-221YN	Chip R	
R 5	" -473YN	"	
R 6	—	—	
R 7	QRS188J-181YN	Chip R	
R 8	" -472YN	"	
R 9	" -472YN	"	
R10	" -102YN	"	
R11	" -472YN	"	
R12	—	—	
R13	QRS188J-223YN	Chip R	
R14	" -223YN	"	
R15	" -562YN	"	
R16	" -104YN	"	
R17	" -124YN	"	
R18	" -563YN	"	
R19	" -273YN	"	
R20	—	—	
R21	QRS188J-271YN	Chip R	
R22	" -332YN	"	
R23	" -333YN	"	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
R24	QVZ3531-104	VR	BATT. ALARM
R25	QRS188J-223YN	Chip R	
R26	—	—	
R27	—	—	
R28	QRS188J-123YN	Chip R	
R29	″ -221YN	″	
R30	—	—	
R31	QRS188J-223YN	Chip R	
R32	QVZ3531-104	VR	BATT. STOP
R33	QRS188J-103YN	Chip R	
R34	″ -104YN	″	
R35	—	—	
R36	QRS188J-332YN	Chip R	
R37	QRD163J-332	CR	
R38	QRS188J-332YN	Chip R	
R39	″ -823YN	″	
R40	″ -332YN	″	
R41	—	—	
R42	QRS188J-332YN	Chip R	
R43	″ -223YN	″	
R44	″ -223YN	″	
R45	″ -681YN	″	
R46	″ -271YN	″	
R47	″ -271YN	″	
R48	″ -103YN	″	
R49	″ -103YN	″	
R50	—	—	
R51	QRS188J-103YN	Chip R	
R52	″ -183YN	″	
R53	″ -473YN	″	
R54	″ -224YN	″	
R55	″ -333YN	″	
R56	″ -223YN	″	
R57	″ -224YN	″	
R58	″ -473YN	″	
R59	″ -223YN	″	
R60	—	—	
R61	QRS188J-223YN	Chip R	
R62	″ -473YN	″	
R63	″ -104YN	″	
R64	″ -104YN	″	
R65	″ -224YN	″	
R66	″ -221YN	″	
R67	″ -103YN	″	
R68	″ -393YN	″	
R69	″ -103YN	″	
R70	—	—	
R71	QRS188J-473YN	Chip R	
R72	″ -473YN	″	
R73	″ -473YN	″	
R74	″ -271YN	″	
R75	″ -103YN	″	
R76	″ -333YN	″	
R77	″ -332YN	″	
R78	″ -473YN	″	
R79	″ -223YN	″	
R80	—	—	
R81	QRS188J-223YN	Chip R	
R82	″ -224YN	″	
R83	″ -105YN	″	
R84	″ -223YN	″	
R85	″ -223YN	″	
R86	″ -332YN	″	
R87	″ -103YN	″	
R88	″ -333YN	″	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
R89	QRD188J-473YN	Chip R	
R90	—	—	
R91	—	—	
R92	QRS188J-223YN	Chip R	
R93	″ -563YN	″	
R94	″ -333YN	″	
R95	—	—	
R96	QRS188J-101YN	Chip R	
R97	″ -103YN	″	
R98	″ -104YN	″	
R99	--	—	
R100	QRS188J-0R0Y	Chip R	
C 1	QEK50JM-107	E Cap	
C 2	QCF81EZ-104	Chip Cap	
C 3	QEK51CM-226	E Cap	
C 4	QCF81EZ-224	Chip Cap	
C 5	PU53603	E Cap	
C 6	QEP51EM-475	″	
C 7	QEK51EM-475G	″	
C 8	QCY81HK-222	Chip Cap	
C 9	QCS81HJ-471	″	
C10	QCF81EZ-104	″	
C11	QEP41EM-475	E Cap	
C12	—	—	
C13	QCF81EZ-104	Chip Cap	
C14	QEK51CM-106G	E Cap	
C15	QEK41CM-106	″	
C16	QEK51CM-106G	″	
C17	—	—	
C18	QEK50JM-226G	E Cap	
C19	QEK40JM-107	″	
C20	QCY81HK-102	Chip Cap	
C21	QEK51HM-105G	E Cap	
C22	QCY81HK-102	Chip Cap	
C23	QFZ9011-104	MY Cap	
C24	QCF81HZ-103	Chip Cap	
	PU50633	LED Spacer	for D1–D10
⚠ CF 1	PU50224	Ceramic Filter	
RA 1	EXB-LD4103G	Resistor Array	
RA 2	EXB-H84495G	″	
RA 3	EXB-LD6103G	″	
RM 1	EXB-UF8302NQ	Resistor Module	
RM 2	″	″	
RM 3	″	″	
S 1	PU53598	Tact Switch	
S 2	″	″	
S 3	″	″	
S 4	″	″	
S 5	″	″	
S 6	″	″	
S 7	″	″	
S 8	PU53599	Push Switch	
S 9	PU53598	Tact Switch	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
	PU53600	Jack Ass'y	
	PU53601	Camera Connector	
⚠	LC4052-01-03	Tape Counter	
	PU53602	Jumper	
CN 1	PU50356-20	Recep. Housing	
CN 2	" -22	"	
CN 3	PU49215-3	Cap Housing	
	SBSE2606Z	Screw	
	PU53460	Test Pin	TP1, 2

8.2.6 Full Erase Head Board 06

Symbol No.	Part No.	Part Name	Recommended Part/ Description
	PU53259-1-2	Circuit Board	
⚠ IC 1	3VT01	Integrated Circuit	
C 1	QFP42AG-333	P Cap	

8.2.7 Junction Board Ass'y 08 .... PU21560A-1

Symbol No.	Part No.	Part Name	Recommended Part/ Description
	PU49215-2R	Housing	
	" -2Y	"	
	" -2	"	
	" -2Y	"	
	" -2R	"	
	" -2	"	
	" -2	"	
	" -2R	"	
	" -2	"	
	" -2Y	"	
	" -3	"	
	" -4	"	
	" -5	"	
	" -2	"	
	PU50355-12	"	
	PU54444-12	"	
	" -28	"	

8.2.8 Reel Sensor Board 09

Symbol No.	Part No.	Part Name	Recommended Part/ Description
	PU53358	Circuit Board	Take-up & Supply
	NJL5142ELB-B	Photo Sensor	
	PU53579	Photo Sensor Case	for Take-up Board
	PU53089	"	for Supply Board

8.2.9 Switching Regulator Board Ass'y 10 . . PU53216C-4

Symbol No.	Part No.	Part Name	Recommended Part/ Description
⚠ IC 1	LVC-152-4	Integrated Circuit	
IC 2	MRR-011-4	"	
⚠ IC 3	BA6132	"	
⚠ Q 1	2SB744-P,Q	Transistor	
D 1	ERB81-004U15A	Diode	
D 2	ERA81-004U16A	"	
D 3	ERB81-004U15A	"	
D 4	"	"	
D 5	"	"	
R 1	RD2.2K-J1/BA	CR	
R 2	"	"	
R 3	"	"	
R 4	RD1M-J1/8A	"	
R 5	"	"	
R 6	"	"	
VR 1	RGS6-FAN-30K	VR	9 V ADJ.
VR 2	"	"	5 V ADJ.
C 1	CEE047A25V	MY Cap	
C 2	"	"	
C 3	CEE101A25V	E Cap	
C 4	"	"	
C 5	CEE101A10V-X	"	
C 6	—	—	
C 7	—	—	
C 8	CEE101A10V-X	E Cap	
C 9	ECEA1AF101	MY Cap	
C10	"	"	
C11	CEE101A10V	E Cap	
C12	"	"	
C13	CEE470A16V	"	
C14	"	"	
C15	CEE101A10V	"	
C16	"	"	
C17	CEE109A50V	MY Cap	
C18	"	"	
C19	CPS102A50J	"	
C20	CCP104N25J	Chip Cap	
C21	—	—	
C22	CCP104N25J	Chip Cap	
C23	"	"	
C24	CE472P-50F	C Cap	
C25	"	"	
C26	"	"	
C27	CCP104N25J	Chip Cap	
C28	CE102P-50F	C Cap	
C29	CCP104N25J	Chip Cap	

Symbol No.	Part No.	Part Name	Recommended Part/ Description
⚠L 1	68-0177B	Choke Coil	
⚠L 2	"	"	
⚠L 3	FS1012-221KR32	"	
⚠L 4	68-0177C	"	
⚠L 5	FS0810-331K	"	
⚠L 6	68-0175B	"	
⚠L 7	FS1012-391KR23	"	
⚠L 8	"	"	
⚠L 9	"	"	
CN 1	SD-5242-12CHPB	Connector	
	68-0166A	Main Case	
	68-0167A	Cover Case	
	68-0168B	Shield Plate	
⚠TF 1	D-98-1.5AL	Fuse	
⚠TF 2	"	"	

8.2.10 End Sensor Board $\boxed{1}\boxed{1}$

Symbol No.	Part No.	Part Name	Recommended Part/ Description
	PU53356	Circuit Board	
	TPS605	Photo Transistor	

8.2.11 L.E.D. Board $\boxed{1}\boxed{2}$

Symbol No.	Part No.	Part Name	Recommended Part/ Description
	PU53357	Circuit Board	
	TLN107	L.E.D.	
	PU53313	L.E.D. Holder	

8.2.12 2H Delay Line Board Ass'y $\boxed{1}\boxed{3}$ . . . PU54281A-2

Symbol No.	Part No.	Part Name	Recommended Part/ Description
IC11	AN607P	Integrated Circuit	
R 1	QRD167J-391	CR	
R 2	" -471	"	
R 3	QVZ3531-222	VR	PB COL. LEVEL
⚠R 4	QRD167J-101	CR	
C 1	PU54070	E Cap	
C 2	QFN31HJ-103	MY Cap	
C 3	" -103	"	
⚠L 1	PU53223-101G	P. Coil	
DL 2	PU54399	Delay Line	
	PU53587-6	Cap Housing	
	PU54292	Bracket	
	SDSP2606Z	Screw	
	LPSP2605Z	"	

8.2.13 Remote Control Unit Board Ass'y

Symbol No.	Part No.	Part Name	Recommended Part/ Description
	PU33697-121	Remote Control P.W.B Ass'y	
	PU53598	Tact SW	QTY 7
RA 1	PU33697-200	Resistor Array	
C 1	PU33697-201	MY CAP	
R 1	QRD181J-103A	Resistor	
R 2	" -183A	"	
R 3	Q " -473A	"	

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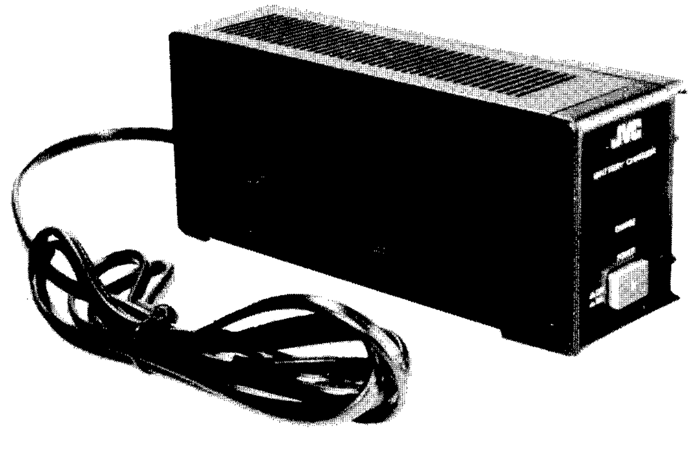
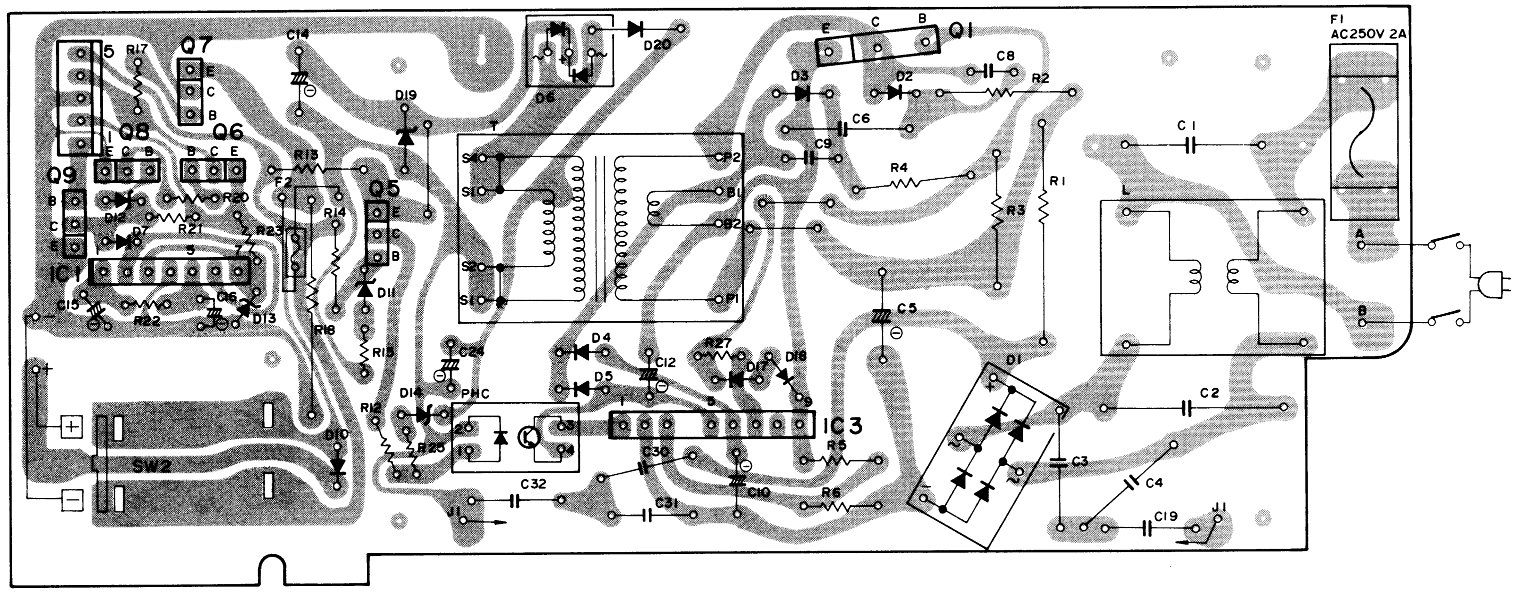


MODEL BB-P3E

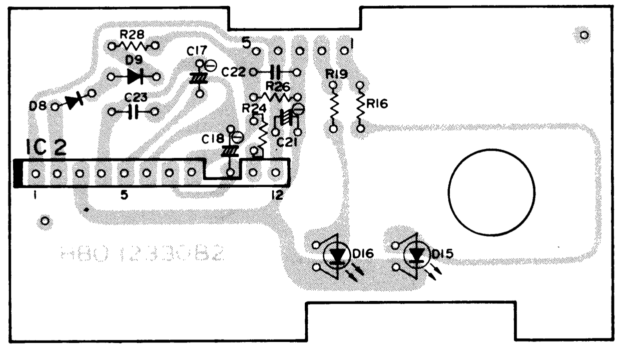
VICTOR COMPANY OF JAPAN, LIMITED

3.2 REGULATOR CIRCUIT BOARD



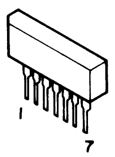
Q7
Q8
Q9
Q6
Q5
IC1
IC3
Q1
E C B
R17
C14
D19
D6
D20
C8
R2
D3
D2
C6
C9
R4
R1
R3
C1
F1
AC250V 2A
L
A
B
T
S3
S1
S2
P2
BU
B2
P1
R13
F2
R14
R20
R21
R23
D12
D7
D11
D13
C15
R22
C16
R18
R15
C24
PHC
D14
R12
R25
D10
SW2
C32
C31
C30
J1
D4
D5
C12
R27
D17
D18
R5
R6
C10
C5
D1
C2
C3
C4
C19

3.3 CHARGING CONTROL CIRCUIT BOARD

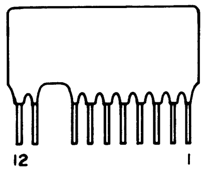


R28
D9
C17
C22
C23
R26
R19
R16
D8
R24
C18
C21
IC 2
1
5
12
D16
D15
HBO 12330B2

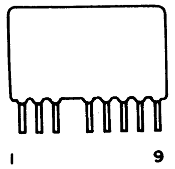
IC1 : AN6780



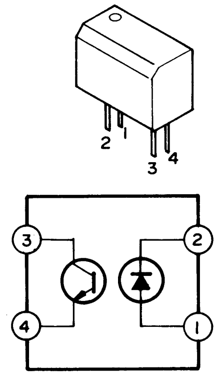
IC2 : BQ-053

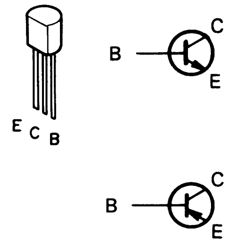


IC3 : EHMJ11L96



PHC : ON3105

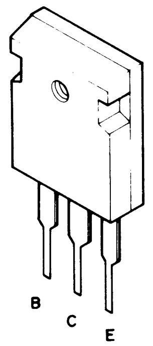




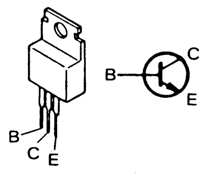
Q5 : 2SA564AR
Q6 : 2SB621AQ

Q8
Q9 : 2SC828QP,Q

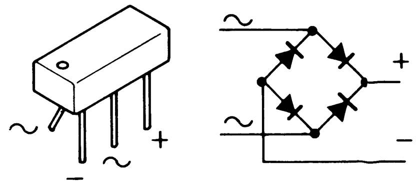
Q1 : 2SC3260



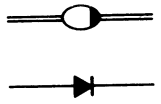
Q7 : 2SD886P,Q



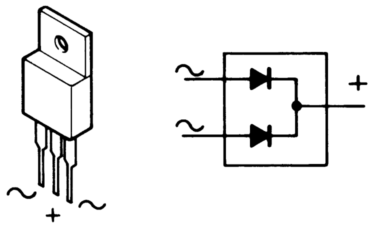
D1 : SIRBA 60



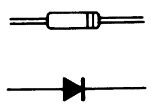
D3, D4, D5 : V06C
D2, D17 : F114-F



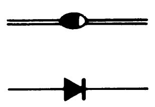
D6 : S5KC20



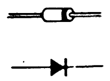
D7, D9 : MA150



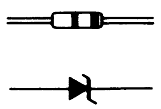
D8 : MA26W



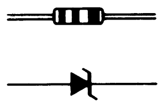
D10 : RK14



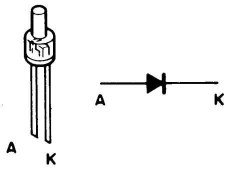
D11 : MA1180L
D14 : MA1160
D19 : MA1240



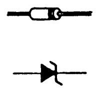
D12 : MA1051
D13 : MA1082



D15, D16 : SR531D

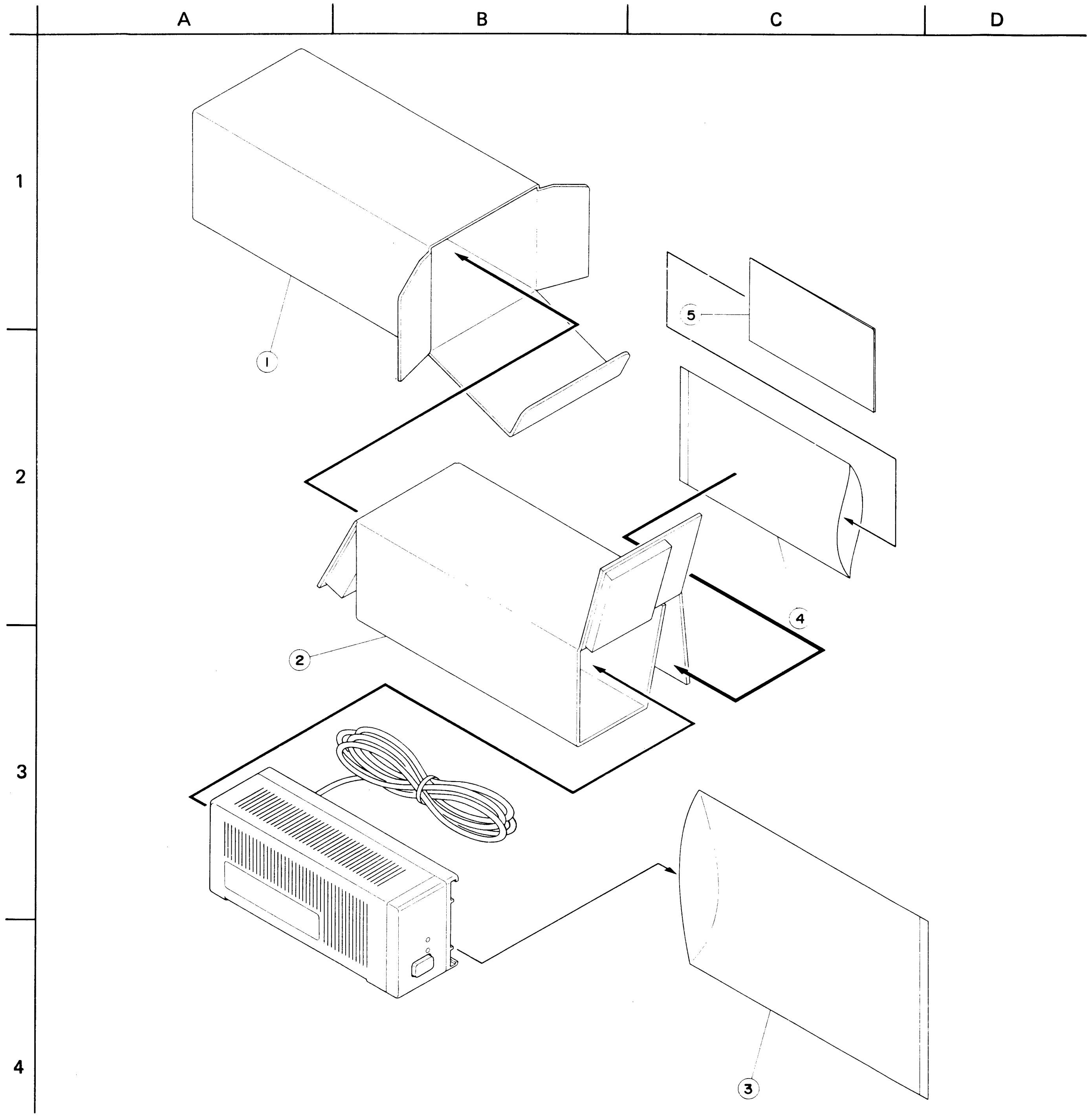


D18 : RD4.7F



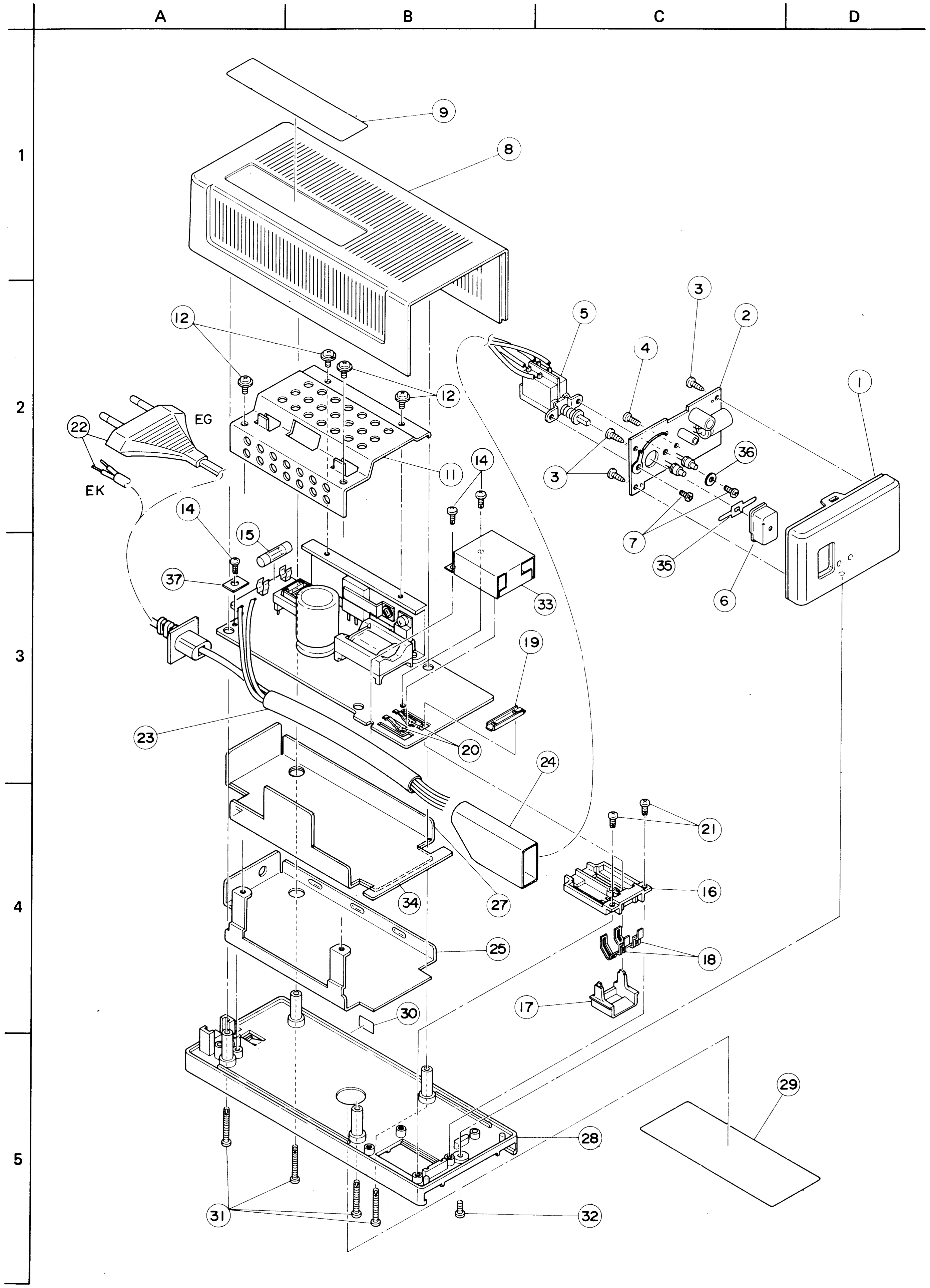
SECTION 4
EXPLODED VIEWS AND PARTS LIST

4.1 PACKING ASSEMBLY


A
B
C
D
1
2
3
4
①
⑤
②
④
③

Symbol No.	Part No.	Part Name	Description	Symbol No. position	Q'ty
1	PU53200-353	Packing Case	EG	2-A	1
	″ -354	″	EK		
2	″ -302	Packing		3-A	1
3	″ -303	Poly Bag A		4-C	1
4	″ -305	″ C		2-C	1
⚠ 5	PU30425-517	Instructions		1-C	1

4.2 BATTERY CHARGER ASSEMBLY


A
B
C
D
1
2
3
4
5
⑨
⑧
③
⑫
⑤
②
④
①
⑫
EG
㉒
⑪
⑭
③
㊱
EK
⑭
⑦
⑮
㉟
㊲
⑥
㉝
⑲
㉓
⑳
㉔
㉑
⑯
㉞
㉗
㉕
⑱
㉚
⑰
㉙
㉘
㉛
㉜

SECTION 1
DISASSEMBLY

1.1 OUTER CASE

1. Remove five screws ①, grasp the front cover and take off the top cover. (Fig. 1-1)

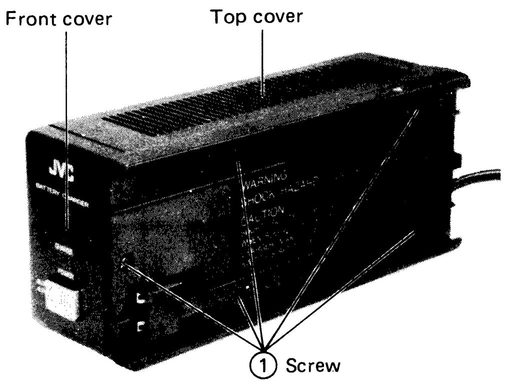

Front cover
Top cover
① Screw

Fig. 1-1

2. Disengage connector Ⓐ from the regulator board assembly and take out two screws ② to remove the cord supporter. Take out four screws ③ to remove the heat sink Ⓑ. (Fig. 1-2)

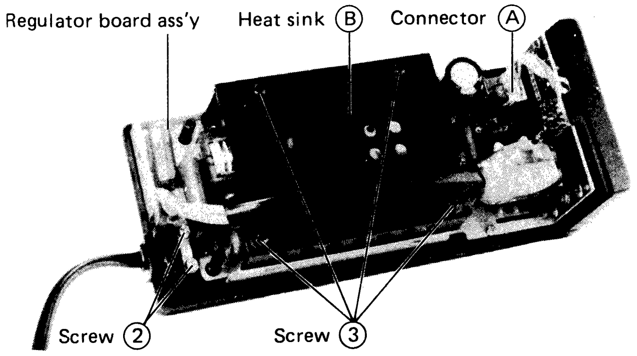

Regulator board ass'y
Heat sink Ⓑ
Connector Ⓐ
Screw ②
Screw ③

Fig. 1-2

3. Take out five screws ④ to remove the battery holder. Disengage the shorting plate from the plastic tabs (use care not to damage the tabs), then remove the terminal cover and terminal mount from the regulator board assembly.

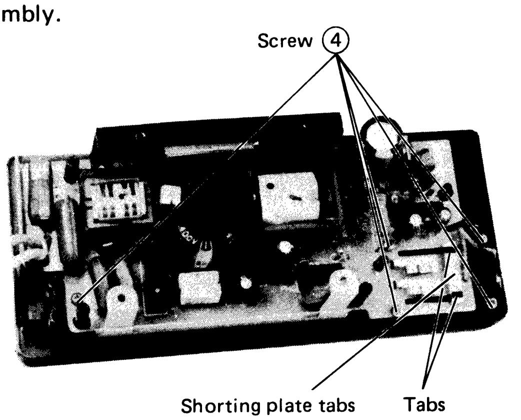

Screw ④
Shorting plate tabs
Tabs

Fig. 1-3

4. Take out four screws ⑤ to remove the front cover.

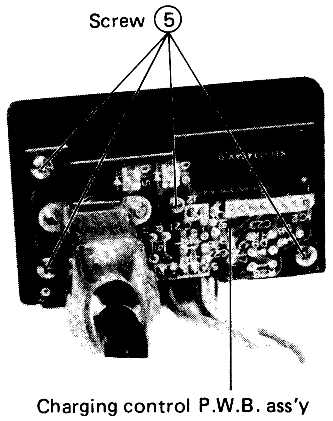

Screw ⑤
Charging control P.W.B. ass'y

Fig. 1-4

SECTION 2
CIRCUIT DESCRIPTION

2.1 GENERAL

This battery charger is for exclusive use with the battery pack of the HR-C3 (NB-P3 and NB-P4). Either of these battery packs can be connected easily and quickly charged.
By use of converter plugs AC power source of 100–240 V can be applied.
The main features are: 1) quick charging by a constant current charging system, 2) over-charging is controlled by the peak detection system, 3) the built-in timer automatically decreases charging current after a certain time elapses. (Timer operates for 120 ± 20 minutes.)

2.2 VOLTAGE REGULATOR

The AC line voltage input is filtered and rectified, then applied to Q1 and the transformer, where it is converted into approximately 30 kHz AC. IC3 responds to input AC variations by controlling the Q1 oscillation pulse width.

At the secondary side, the output voltage is controlled by the charge stored in C14. Consequently, with peak-to-peak (p-p) variation of the input AC, by varying the pulse width, the C14 charge functions to stabilize the variation.

A photocoupler (PHC) monitors load variations and IC3 controls the output accordingly.

2.3 QUICK CHARGING CONTROL

Generally, charging of a sealed type nickel-cadmiun (NiCd) battery is performed using a low current over a period of 14 to 16 hours. This method is the most reliable for avoiding risk of damage or deterioration due to overcharging.

Quick charging, however, requires a rather high current. Therefore, a means is needed to detect and control the final stage of charging.

The employed method utilizes the property of the battery pack under quick charge of reaching a maximum voltage (Vp), then experiencing a voltage drop (see Fig. 2-1).

Battery voltage is detected at pins 1 and 12 of IC2. At the peak voltage (Vp), high potential appears at pin 2. This switches Q9 off, and Q8, Q7 and Q6 off. The charging loop then goes through R18, thereby reducing the charging current to 1/10th.

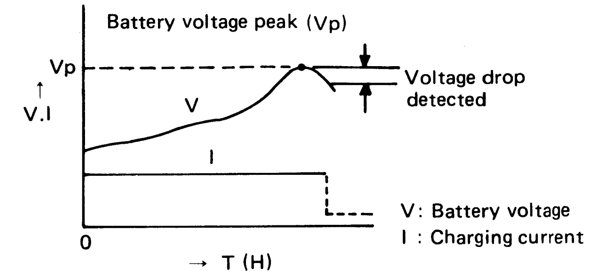


Fig. 2-1

2.4 TIMER CONTROL

This charging control system is independent of the above described peak detection method.

The internal timer of IC1 begins operation with the start of charging. After 120 ± 20 minutes elapse, low potential appears at IC1 output pins 2 and 6, thereby changing the charging loop to a low current, in the same manner as quick charge.

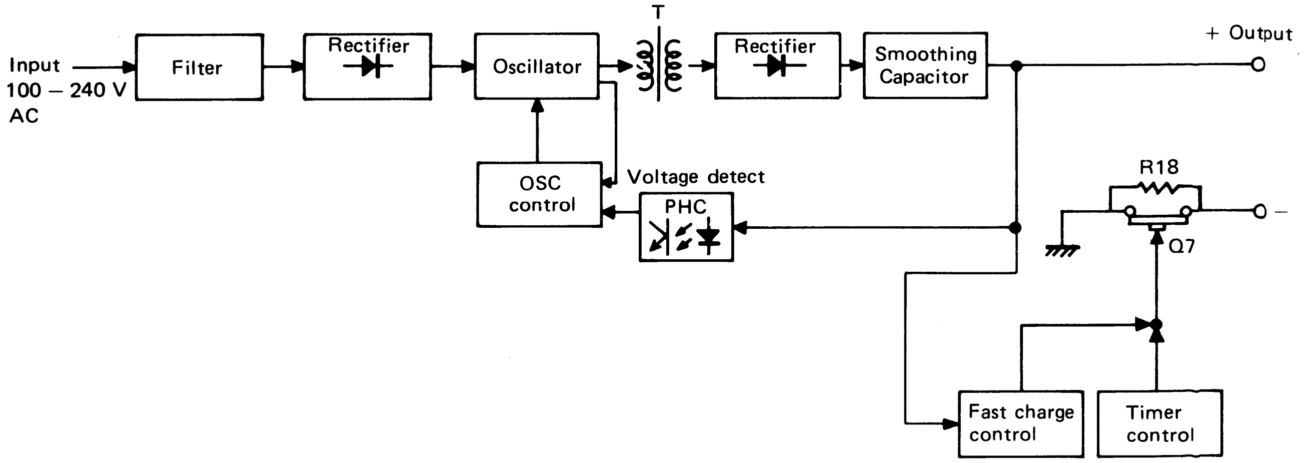
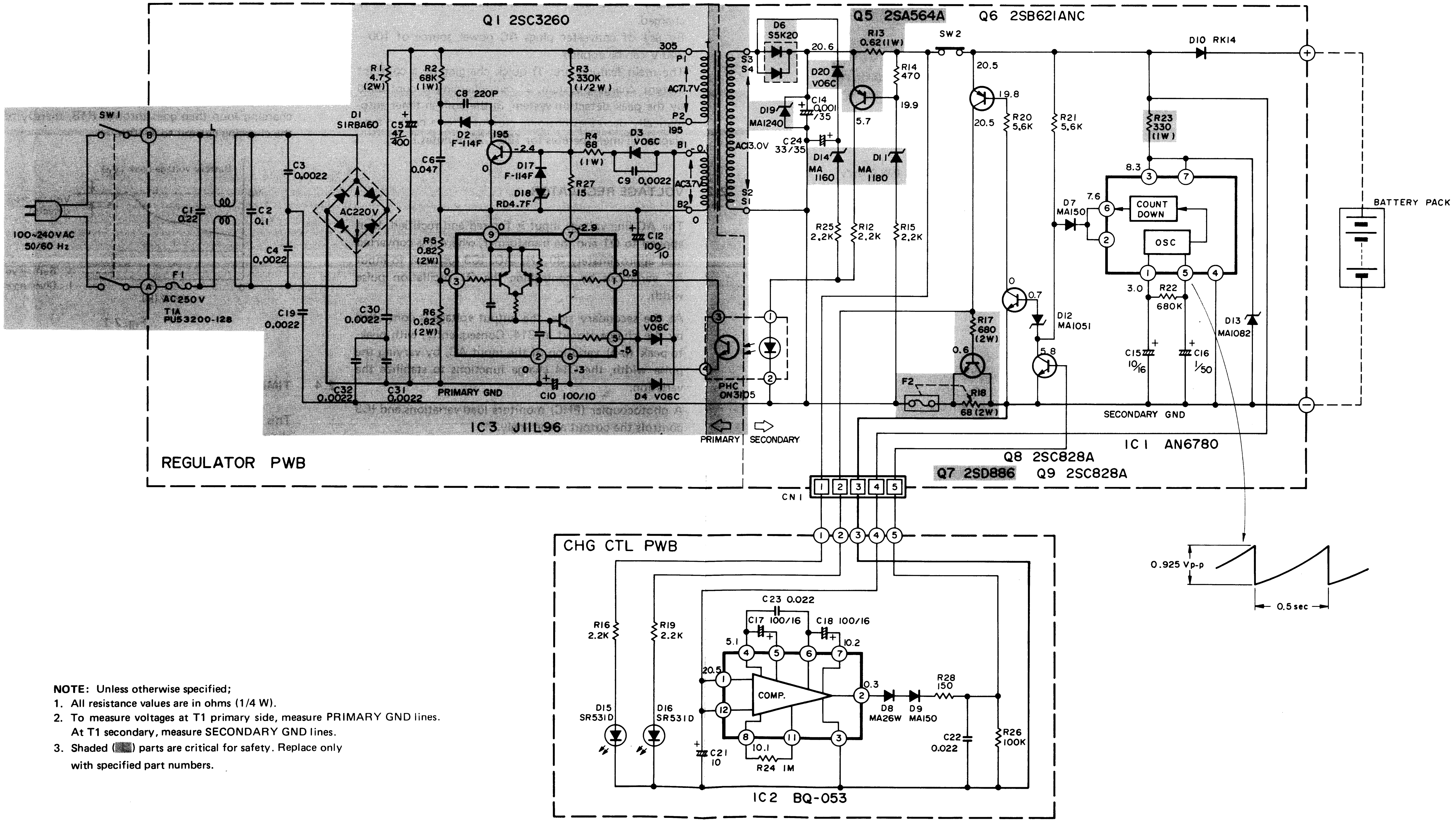

Input
100 – 240 V
AC
Filter
Rectifier
Oscillator
T
Rectifier
Smoothing Capacitor
+ Output
OSC control
Voltage detect
PHC
R18
Q7
–
Fast charge control
Timer control

Fig. 2-2 BB-P3E Block diagram

SECTION 3
SCHEMATIC AND CIRCUIT BOARD DIAGRAM

3.1 BB-P3E SCHEMATIC DIAGRAM



Q1 2SC3260
Q5 2SA564A
Q6 2SB621ANC
SW1
SW2
D1 SIRBA60
D6 S5K20
D10 RK14
R1 4.7 (2W)
R2 68K (1W)
R3 330K (1/2W)
C8 220P
D2 F-114F
C5 47/400
C6 0.047
R4 68 (1W)
D3 V06C
C9 0.0022
D17 F-114F
D18 RD4.7F
R27 15
R5 0.82 (2W)
R6 0.82 (2W)
C12 100/10
D5 V06C
C30 0.0022
C31 0.0022
C32 0.0022
C19 0.0022
C1 0.22
C2 0.1
C3 0.0022
C4 0.0022
AC220V
100~240VAC 50/60 Hz
F1 AC250V T1A
PU53200-128
PRIMARY GND
C10 100/10
D4 V06C
IC3 J11L96
PHC ON3105
REGULATOR PWB
PRIMARY
SECONDARY
305
P1
AC71.7V
P2
195
B1
B2
AC3.7V
AC13.0V
S1
S2
S3
S4
20.6
D20 V06C
D19 MA1240
C14 0.001 /35
C24 33/35
D14 MA 1160
D11 MA 1180
R13 0.62 (1W)
R14 470
19.9
5.7
20.5
19.8
R20 5.6K
R21 5.6K
R23 330 (1W)
R25 2.2K
R12 2.2K
R15 2.2K
R17 680 (2W)
0.6
F2
R18 68 (2W)
0.7
D12 MA1051
5.8
D7 MA150
8.3
7.6
COUNT DOWN
OSC
3.0
R22 680K
D13 MA1082
C15 10/16
C16 1/50
SECONDARY GND
IC1 AN6780
Q8 2SC828A
Q7 2SD886
Q9 2SC828A
BATTERY PACK
CN1
CHG CTL PWB
R16 2.2K
R19 2.2K
D15 SR531D
D16 SR531D
C21 10
C23 0.022
C17 100/16
C18 100/16
5.1
10.2
20.5
COMP.
0.3
D8 MA26W
D9 MA150
R28 150
C22 0.022
R26 100K
10.1
R24 1M
IC2 BQ-053
0.925 Vp-p
0.5 sec

NOTE: Unless otherwise specified;
1. All resistance values are in ohms (1/4 W).
2. To measure voltages at T1 primary side, measure PRIMARY GND lines. At T1 secondary, measure SECONDARY GND lines.
3. Shaded (▨) parts are critical for safety. Replace only with specified part numbers.

BB-2

— Battery charger assembly list —

Symbol No.	Part No.	Part Name	Description	Symbol No. position	Q'ty
⚠ 1	PU53200-501	Front Cover		2-D	1
2	—	Charge Control P.W.B Ass'y		2-C	1
3	PU53200-002	Screw		2-C	3
4	〃 -242	〃		2-C	1
⚠ 5	〃 -028	Power Switch		2-C	1
6	〃 -005	Switch Button		3-C	1
7	SPSP3006	Screw		3-C	2
⚠ 8	PU53200-030	Top Cover Ass'y	Incl.⑨ EG	1-B	1
	〃 -056	〃	Incl.⑨ EK		
⚠ 9	〃 -044	Rating Plate	EG	1-B	1
	〃 -171	〃	EK		
10	—	—		—	—
11	PU53200-010	Heat Sink B		2-B	1
12	〃 -012	Screw		2-A, 2-B	4
13	—	Regulator P.W.B Ass'y		—	—
14	PU53200-003	Screw		2-B	3
⚠ 15	〃 -128	Fuse		3-A	1
16	〃 -013	Terminal Plate		4-C	1
17	〃 -014	Terminal Cover		4-B	1
18	〃 -015	Charging Plate		4-C	-
19	〃 -016	Shorting Plate		3-B	1
20	〃 -017	Shorting Spring		3-B	2
21	〃 -003	Screw		4-C	2
⚠ 22	〃 -031	AC Power Cord	EG	2-A	1
	〃 -032	〃	EK		
⚠ 23	〃 -033	Tube B		3-A	1
⚠ 24	〃 -231	Switch Cover		3-C	1
⚠ 25	〃 -034	Shield Cover		4-B	1
26	—	—		—	—
⚠ 27	PU53200-035	Insulator Plate A		4-B	1
⚠ 28	〃 -037	Battery Holder Ass'y	Incl. ㉙ , ㉚	5-C	1
⚠ 29	〃 -041	Caution Label		5-D	1
30	〃 -025	Position Sticker		4-B	1
31	〃 -027	Screw		5-A	4
32	〃 -026	〃		5-C	1
33	〃 -038	Shorting Plate Cover		3-C	1
34	〃 -036	Insulator Plate B		4-B	1
35	〃 -228	Earth Plate		3-C	1
36	〃 -050	Washer		2-C	1
37	〃 -230	Plastic Washer		3-A	1

SECTION 5
ELECTRICAL PARTS LIST

5.1 Regulator P.W.B. Ass'y

Symbol No.	Part No.	Part Name	Recommended Part/ Description
	PU53200-053	Regulator P.W.B. Ass'y	
IC 1	AN6780	Timer IC	
IC 2	–	–	
IC 3	EHMJ11L96	Control IC	
Q 1	2SC3260	Transistor	
Q 2	–	–	
Q 3	–	–	
Q 4	–	–	
Q 5	2SA564AR	Transistor	
Q 6	2SB621AQ	"	
Q 7	2SD886P	"	
Q 8	2SC828AP	"	
Q 9	"	"	
⚠ D 1	SIRBA60	Diode Stack	
⚠ D 2	F-114F	Diode	
⚠ D 3	VO6C	"	
⚠ D 4	"	"	
⚠ D 5	"	"	
⚠ D 6	S5KC20	"	
D 7	MA150	"	
D 8	–	–	
D 9	–	–	
D10	RK14	Schottky Diode	
⚠ D11	MA1180L	Zener Diode	
D12	MA1051	"	
D13	MA1082	"	
⚠ D14	MA1160	"	
D15	–	–	
D16	–	–	
⚠ D17	F-114F	Diode	
⚠ D18	RD4.7F	Zener Diode	
D19	MA1240	"	
D20	VO6C	Diode	
⚠ R 1	QRF021K-2R2	Unflammable R	
⚠ R 2	QRG016J-683	OMR	
⚠ R 3	QRC122K-334	Comp. R	
⚠ R 4	QRG016J-680	OMR	
⚠ R 5	PU53200-102	Metal Plate R	
⚠ R 6	" -102	"	
R 7	–	–	
R 8	–	–	
R 9	–	–	
R10	–	–	
R11	–	–	
R12	QRD143J-222	CR	
⚠ R13	QRX016J-R62	MFR	
R14	QRD143J-471	CR	
R15	" -222	"	
R16	–	–	
⚠ R17	QRG026J-681	OMR	
⚠ R18	QRF0291K-680	"	
R19	–	–	
R20	QRD143J-562	CR	
R21	" -562	"	
R22	" -684	"	
⚠ R23	QRG016J-331	OMR	
R24	–	–	
R25	QRD143J-222	CR	
R26	–	–	
⚠ R27	QRD143J-150	CR	
⚠ C 1	PU53200-120	Polyester Cap	
⚠ C 2	" -121	"	
⚠ C 3	" -122	"	
⚠ C 4	" -122	"	
⚠ C 5	" -106	E Cap	
⚠ C 6	" -107	Polyester Cap	
C 7	–	–	
⚠ C 8	PU53200-108	C Cap	
⚠ C 9	" -109	Polyester Cap	
⚠ C10	QET51AM-107	E Cap	
C11	–	–	
⚠ C12	QET51AM-107	E Cap	
C13	–	–	
C14	QET41VM-108	E Cap	
C15	QET51CM-106	"	
C16	PU53200-114	"	
C17	–	–	
C18	–	–	
⚠ C19	PU53200-122	Polyester Cap	
C24	QET51VM-336	E Cap	
⚠ C30	PU53200-122	C Cap	
⚠ C31	" -122	"	
⚠ C32	" -122	"	
PHC	ON3105	Photo Coupler	
⚠ T 1	PU53200-125	Switching Transformer	
⚠ L 1	PU53200-126	Filter Choke Coil	
⚠ F 1	PU53200-128	Fuse	(250 V, 1A)
⚠ F 2	" -127	Thermal Fuse	126°C 2A
⚠	" -118	Fuse Chip	
	" -119	Connector	
	PU53200-220	Heat Sink A	
	PU53200-029	Screw (ϕ3 x 6)	for Heat Sink A
	" -204	Lock Washer	for Heat Sink A
	" -047	Transistor Bracket	for Q1
	" -229	Screw (M3 x 5)	for Q1
	" -201	Screw	for D6
	" -207	Bushing	for D6
	" -221	Mylar Sheet	for Q1
	" -240	Silicone Sheet	for Q1
	" -206	"	for D6
	PU53200-232	Cover	for T
	" -233	"	for L
	" -234	Cap Cover A	for C3, C4, C30, C31
	" -235	" B	for C1
	" -236	" C	for C5
	" -237	" D	for C19, C32
	" -238	" E	for C19, C32

5.2 Charging Control P.W.B. Ass'y

Symbol No.	Part No.	Part Name	Recommended Part/ Description
	PU53200-514	Charging Control P.W.B. Ass'y	
IC 2	BQ-053	Charging Control IC	
D 8	MA26W	Diode	
D 9	MA150	"	
D15	SR531D	LED	
D16	"	"	
R16	QRD143J-222	CR	
R17	—	—	
R18	—	—	
R19	QRD143J-222	CR	
R20	—	—	
R21	—	—	
R22	—	—	
R23	—	—	
R24	QRD143J-105	CR	
R25	—	—	
R26	QRD143J-104	CR	
R27	—	—	
R28	QRD143J-151	CR	
C17	QET41CM-107	E Cap	100/16
C18	PU52802-107	"	"
C19	—	—	
C20	—	—	
C21	QET41EM-106	E Cap	10/25
C22	PU53200-219	C Cap	0.022/50
C23	" -219	"	"

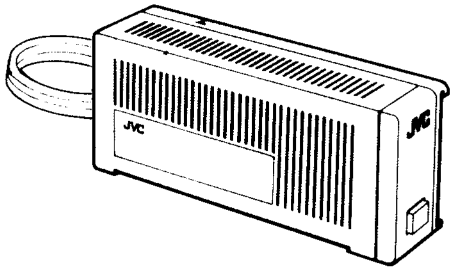
INSTRUCTIONS
MANUEL D'INSTRUCTIONS/BEDIENUNGSANLEITUNG

JVC

BB-P3

BATTERY CHARGER
CHARGEUR DE BATTERIE
BATTERIE-LADEGERÄT

Specifically for the BB-P3EG/EK/S
Spécial pour le BB-P3EG/EK/S
Bedienungsanleitung für das Modell BB-P3EG/EK/S



PU30425-517

JVC
VICTOR COMPANY OF JAPAN, LIMITED

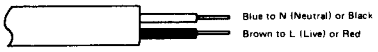
OCT2 EG/EK/S Printed in Japan
PU30425-517

Thank you for purchasing the JVC BB-P3EG/EK/S Battery Charger. The BB-P3EG/EK/S is for use exclusively with the NB-P3U and NB-P4U battery packs which power the JVC HR-C3 Compact Video Cassette Recorder. To avoid problems and obtain the best results, please read this instruction booklet carefully before use.

IMPORTANT (in the United Kingdom)

IMPORTANT

Do not make any connection to the Larger Terminal coded E or Green. The wires in the mains lead are coloured in accordance with following code:



If these colours do not correspond with the terminal identifications of your plug, connect as follows:
Blue wire to terminal coded N (Neutral) or coloured Black.
Brown wire to terminal coded L (Live) or coloured Red.
If in doubt – consult a competent electrician.

CAUTION
To prevent electric shock, do not open the cabinet. No user serviceable parts inside. Refer servicing to qualified service personnel.

CAUTION
If malfunctioning occurs, stop using the unit immediately, unplug the power cord and consult your local JVC dealer.

CAUTION: When you are not using this unit for a long period of time, it is recommended that you disconnect the power cord from AC outlet.

WARNING:
TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS UNIT TO RAIN OR MOISTURE.

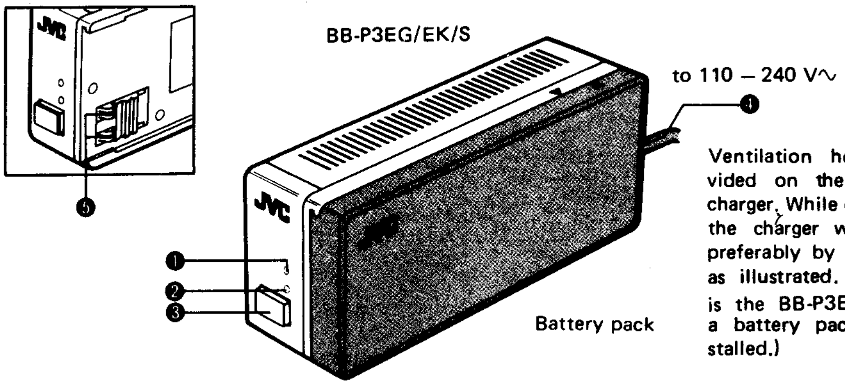
This unit should be used with 110 – 240 V∿, 50/60 Hz only.
CAUTION:
To prevent electric shocks and fire hazards, do NOT use any other power source.

NOTE:
The rating plate (Serial number plate) is on the side of the unit.

PRECAUTIONS

- If used near a radio, this unit may interfere with reception.
- Prevent inflammables, water and metallic objects from entering the unit.
- Do not disassemble or modify the unit.
- Do not apply shocks to the unit.
- Do not subject the unit to direct sunlight.
- Avoid using the unit in extremely hot or humid places.
- Avoid using the unit in places subject to vibrations.

IDENTIFICATION



Ventilation holes are provided on the side of the charger. While charging, keep the charger well ventilated preferably by standing it up as illustrated. (Shown here is the BB-P3EG/EK/S with a battery pack already installed.)

❶ **CHARGE indicator**
Remains lighted during charging and goes off when charging is completed.

❷ **POWER/SECTEUR indicator**
Lights when the POWER button is pressed to ON/M.

❸ **POWER/SECTEUR button**
Charging starts when this button is pressed to ON/M.

❹ **AC power cord**

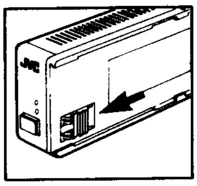
❺ **Terminals**

Charging time
NB-P3U: Approx. 60 minutes
NB-P4U: Approx. 90 minutes

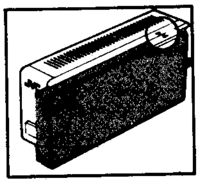
- The charging time differs depending on the ambient temperature and the condition of the battery pack.

OPERATION

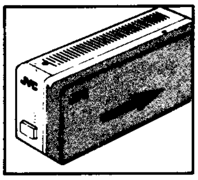
CAUTION: When sliding the battery pack on and off the charger, make sure that the charger's POWER/SECTEUR switch is set to OFF/A.



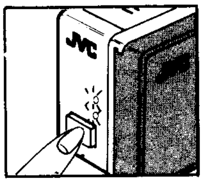
The terminals on the charger are covered by the terminal cover which is automatically opened and closed by sliding the battery pack on and off the charger. If the terminal is out of place and the terminals are exposed, attaching the battery pack is impossible. Slide the cover in the direction of the arrow, if necessary.



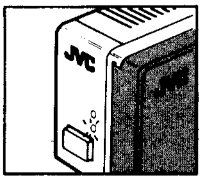
1. Align the marks.



2. Slide the battery pack in the direction of the arrow until it locks in place.
3. Connect the AC power cord to a wall outlet.

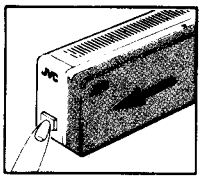


4. Press the POWER/SECTEUR button to ON/M. The POWER/SECTEUR indicator will light first, then the CHARGE indicator will light in a few seconds.



5. When charging is completed, the CHARGE indicator goes off.

- Faint oscillations may be heard at the start of charging. This is not due to any defect of the unit.



6. Press the POWER/SECTEUR button to OFF/A. and remove the battery pack by sliding it off.

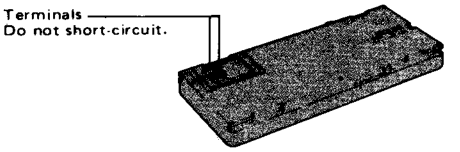
- The battery pack becomes warm immediately after being charged. This is not due to any defect of the unit.

CAUTION

- Short-circuited terminals are very dangerous. After removing the battery pack, check to be sure that the terminals are not exposed.
- If the POWER/SECTEUR button is left in its ON/M. position after the CHARGE indicator goes off, additional charging continues with a small amount of current.

A WORD ON THE EXCLUSIVE NB-P3U/NB-P4U BATTERY PACKS

The NB-P3U/NB-P4U are rechargeable batteries. Give attention to the following to make the most of their characteristics.



Temperature ranges:
The recharging time is based on room temperature of 20°C. The lower the temperature, the longer the recharging time.

For charging:	10°C to 35°C
For operating:	-10°C to 40°C
For storing:	-10°C to 30°C

This battery pack has been kept in the uncharged state for shipment. Therefore, before use, be sure to charge it.

- **Avoid repeated charging.**
  Charging the battery pack repeatedly without using it may cause over-charging and shorten its service life.
- **Recharge using only a specified charger at 10°C to 35°C.**
  Especially avoid recharging in a place under 10°C, as it may cause over-charging.
- **After use, store in a discharged condition.**
- **Do not store in places of high temperatures.**
  Choose a dry place with temperatures between -10°C and 30°C for optimum storage.
- **The battery pack becomes warm immediately after being charged. This is not due to any defect.**

Caution

The terminals are exposed on the bottom of the battery pack. DO NOT short-circuit these terminals.

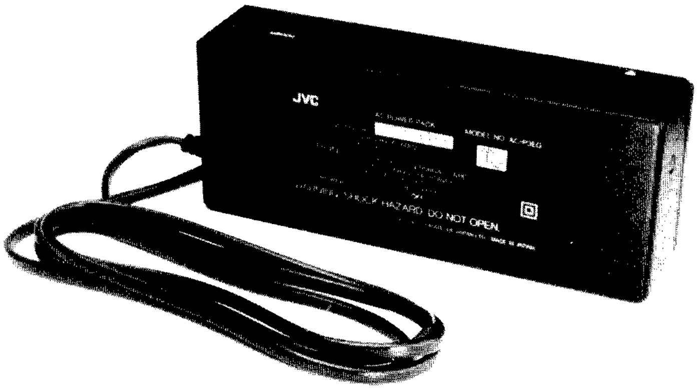
- If they are shorted, a great amount of current flows. This is not only very dangerous, but also makes the battery pack unusable.
- When transporting or storing the battery pack, exercise special care so that no metallic object touches the terminals.
- Always keep the terminals clean. If they become dirty, wipe them with a piece of soft cloth.

BB-P3EG/EK/S SPECIFICATIONS

Charging system : Constant current, peak detection, timer controlled.
Power supply : 110 – 240 V∿, 50/60 Hz
Power consumption : 25 watts
Output : 12 V ⎓ 0.8 A max.
Dimensions : 57(W) x 74(H) x 182(D) mm
Weight : 550 g

No. 8260($^3/_5$)

JVC Service Manual



MODEL AC-P3E

VICTOR COMPANY OF JAPAN, LIMITED

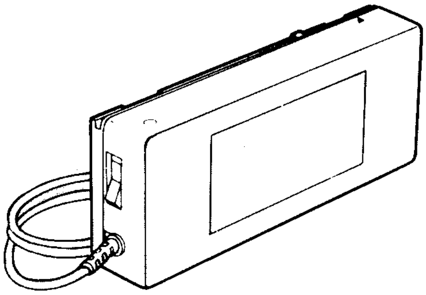
INSTRUCTIONS
MANUEL D'INSTRUCTIONS/BEDIENUNGSANLEITUNG

JVC

AC-P3

AC POWER PACK
ADAPTATEUR SECTEUR
NETZADAPTER

Specifically for the AC-P3EG/EK/S
Spécial pour le AC-P3EG/EK/S
Bedienungsanleitung für das Modell AC-P3EG/EK/S



PU30425-518

JVC
VICTOR COMPANY OF JAPAN, LIMITED

OCT2 EG/EK/S Printed in Japan
PU30425-518

Thank you for purchasing the JVC AC-P3EG/EK/S AC Power Pack. The AC-P3EG/EK/S is for use exclusively with the JVC HR-C3 Compact Video Cassette Recorder. To avoid problems and obtain the best results, please read this instruction booklet carefully before use.

IMPORTANT (In the United Kingdom)

IMPORTANT

Do not make any connection to the Larger Terminal coded E or Green. The wires in the mains lead are coloured in accordance with following code:

Blue to N (Neutral) or Black
Brown to L (Live) or Red

If these colours do not correspond with the terminal identifications of your plug, connect as follows:
Blue wire to terminal coded N (Neutral) or coloured Black.
Brown wire to terminal coded L (Live) or coloured Red.
If in doubt – consult a competent electrician.

CAUTION
To prevent electric shock, do not open the cabinet. No user serviceable parts inside. Refer servicing to qualified service personnel.

CAUTION
If malfunctioning occurs, stop using the unit immediately, unplug the power cord and consult your local JVC dealer.

CAUTION: When you are not using this unit for a long period of time, it is recommended that you disconnect the power cord from AC outlet.

WARNING:
TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS UNIT TO RAIN OR MOISTURE.

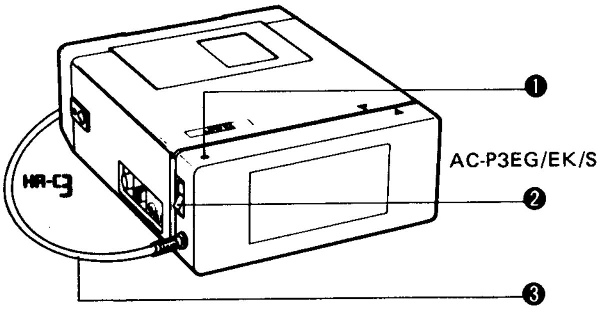
This unit should be used with 110 – 240 V∿, 50/60 Hz only.
CAUTION:
To prevent electric shocks and fire hazards, do NOT use any other power source.

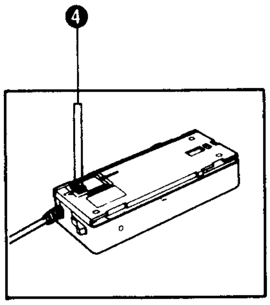
NOTE:
The rating plate (Serial number plate) is on the side of the unit.

PRECAUTIONS

- If used near a radio, this unit may interfere with reception.
- Do not disassemble or modify the unit, as this will cause danger and malfunctioning.
- Do not apply violent shocks to the unit.
- Avoid using the unit in extremely hot or humid places.
- Avoid using the unit in places subject to vibrations.

IDENTIFICATION





❶ **POWER/SECTEUR indicator**
Lights red when the POWER/SECTEUR switch is set to ON/MARCHE.

❷ **POWER/SECTEUR switch**
Set to ON/MARCHE to supply power and to OFF/ARRET to cut power.

❸ **AC power cord**

❹ **Terminals**

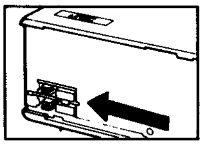
Notes:

- DO NOT short-circuit the terminals when the power cord is plugged in.
- Always keep the terminals clean. If they become dirty, wipe them with a piece of soft cloth.
- After long periods of continuous use, the cabinet of this unit may become warm. This is not due to any defect.

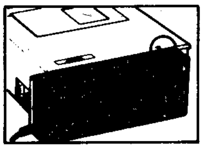
OPERATION

CAUTION: When sliding the power pack on and off the HR-C3, make sure that the power pack's POWER/SECTEUR switch is set to OFF/ARRET.

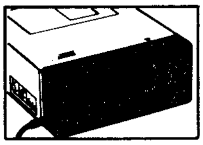
To attach



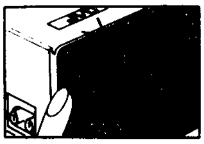
The terminals on the rear of the HR-C3 are covered by the terminal cover, which is automatically opened and closed by sliding the power pack on and off the HR-C3. If the terminal cover is out of place and the terminals are exposed, attaching the power pack is impossible. Slide the cover in the direction of the arrow, if necessary.



1. Align the marks.

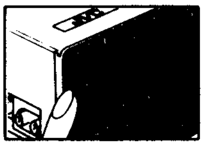


2. Slide the power pack in the direction of the arrow until it locks in place.
3. Connect the AC power cord to a wall outlet.

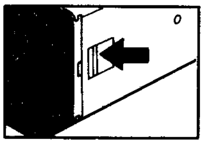


4. Set the POWER/SECTEUR switch to ON/MARCHE.
The POWER/SECTEUR indicator will light, and the HR-C3 will be powered.

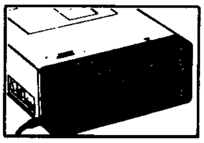
To remove



1. Press the POWER/SECTEUR switch to OFF/ARRET.



2. While pressing the release button on the HR-C3 . . .



3. . . . slide the power pack off.

AC-P3EG/EK/S SPECIFICATIONS

Output	: 12 V ⎓ , 1.7 A max.
Power supply	: 110 – 240 V∿, 50/60 Hz
Power consumption	: 10 W with HR-C3 30 W with 12 V⎓, 1.7 A load
Dimensions	: 43(W) x 74(H) x 183(D) mm
Weight	: 720 g

SECTION 1
DISASSEMBLY

1.1 OUTER CASE

1. Take out three black screws ⑬.
2. Remove the cover ② by pulling it upward.

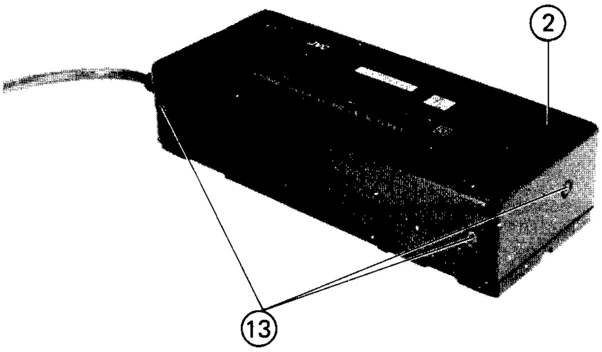


Fig. 1-1

1.2 CIRCUIT BOARD

1. Remove the insulating board ⑰ and ⑦.
2. Peel off the label ⑨.

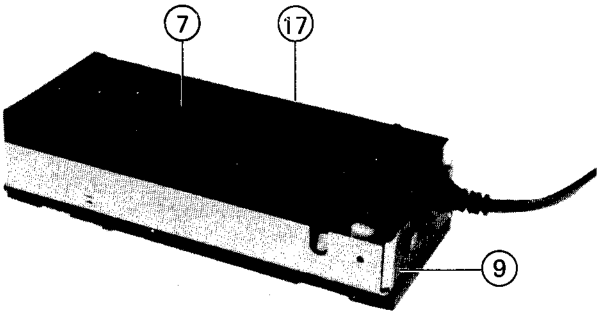


Fig. 1-2

3. Take out the screw ⑲ and remove the holder ⑱. (Fig. 1-3)

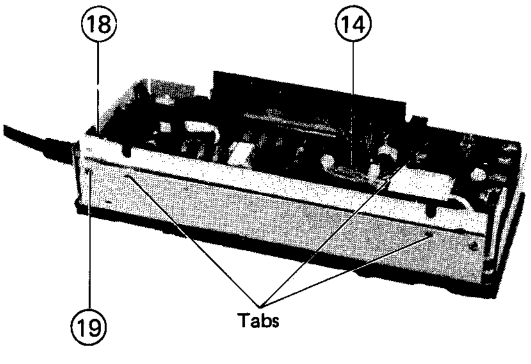


Fig. 1-3

4. Take out two screws ⑪ and two screws ⑫ (Fig. 1-4), then remove the AC Power Pack P.W.B. Assembly ⑭ (Fig. 1-3).
   As the printed board is held by tabs (Fig. 1-3), pry it free by using a screwdriver or other tools.

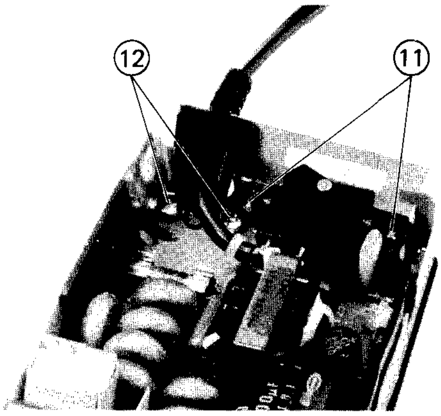


Fig. 1-4

1.3 FRAME

1. Take out three black screws ⑩.

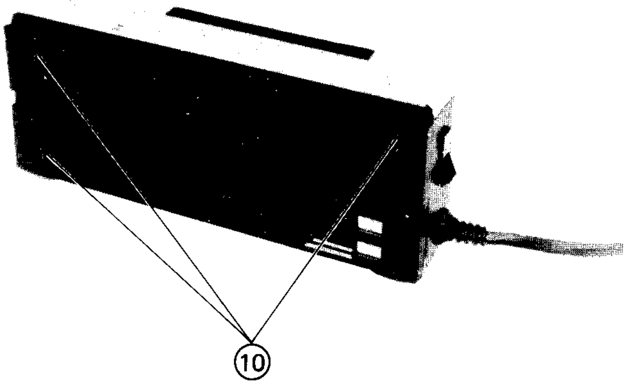


Fig. 1-5

1.4 PRECAUTIONS DURING REPAIRING

1. Before repairing, confirm that the voltage at both ends of capacitor C10 is lower than 30 V after the power switch is turned off.

SECTION 2
ADJUSTMENT

2.1 OUTPUT VOLTAGE ADJUSTMENT

Connect a DC voltmeter to the output and adjust the variable resistor (R16) to set the output at 12.3 V. (Apply a dummy load of more than 8.3 Ω, 40 W and measure the output voltage at the terminal side. Quick adjustment is required because the load accumulates heat.)

Note: Do not allow the output voltage to exceed 12.4 V.

SECTION 3
CIRCUIT OPERATION

3.1 GENERAL DESCRIPTION

1. AC line voltage goes via the switch and fuse to the input filter, then to the rectifier. The resulting DC voltage is converted into approximately 50 kHz (at rated load) AC by transistor Q1 and transformer T1. This is again rectified by through CR8, C16 to C20, and chokes L4 to become a 12 V DC output. The red LED lights when power is activated.

   Variable resistor R16 adjusts the output voltage. Care must be taken that this does not exceed 12.4 V in order to avoid possible damage to connected equipment (perform adjustment at the rated current).

2. While output current is low, Q1 base current becomes supplied from R9, R10, C15 and R20. AC produced at the base winding of T1 is rectified at CR6 and controlled so that the voltage at both ends of C14, C24 becomes approximately 7.4 V (which is the zener voltage of CR5, CR15 – 0.8 V).

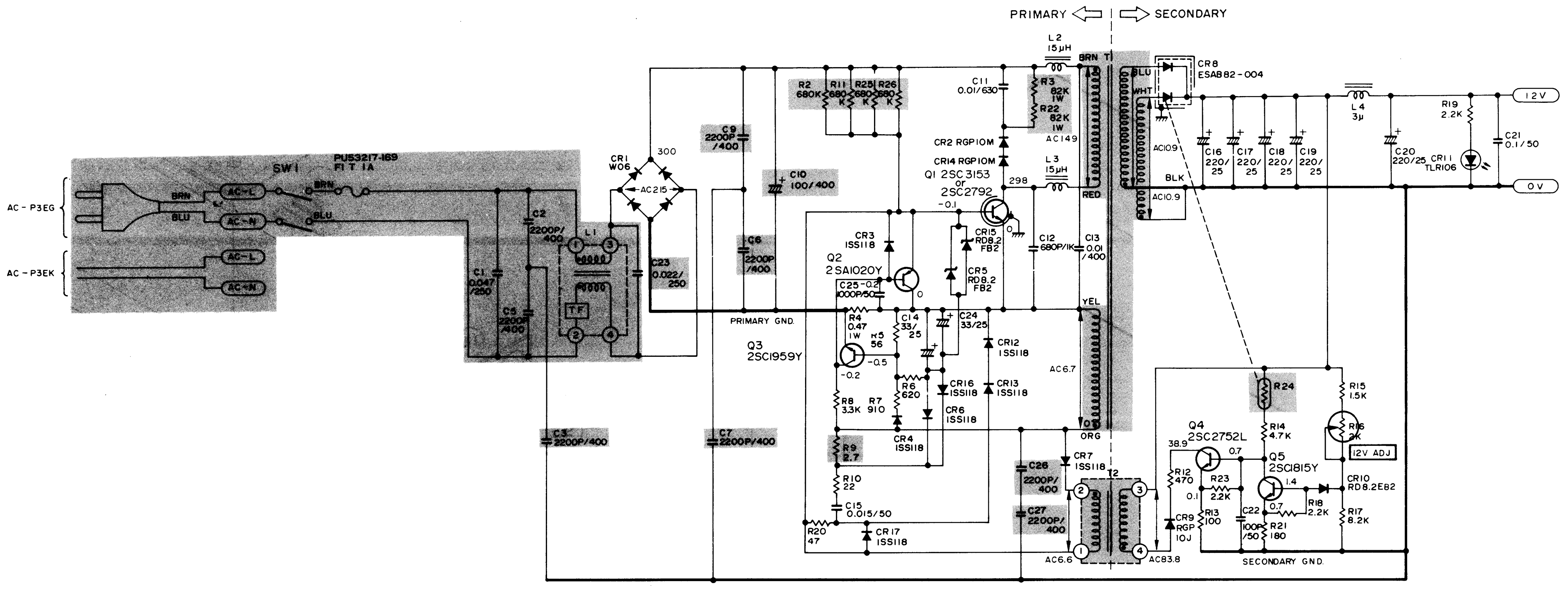
   When the output current increases, the Q1 base current from only R9, R10, C15 and R20 becomes insufficient, and the output voltage tends to decline. The decline is detected by the output voltage detector and corresponding data are sent via T1 to the primary side. Additional base current is then supplied to Q1 to prevent output voltage decline.

3. In event of overcurrent, the voltage at both ends of R4 increases. Q2 and Q3 switch on to absorb the Q1 base current.

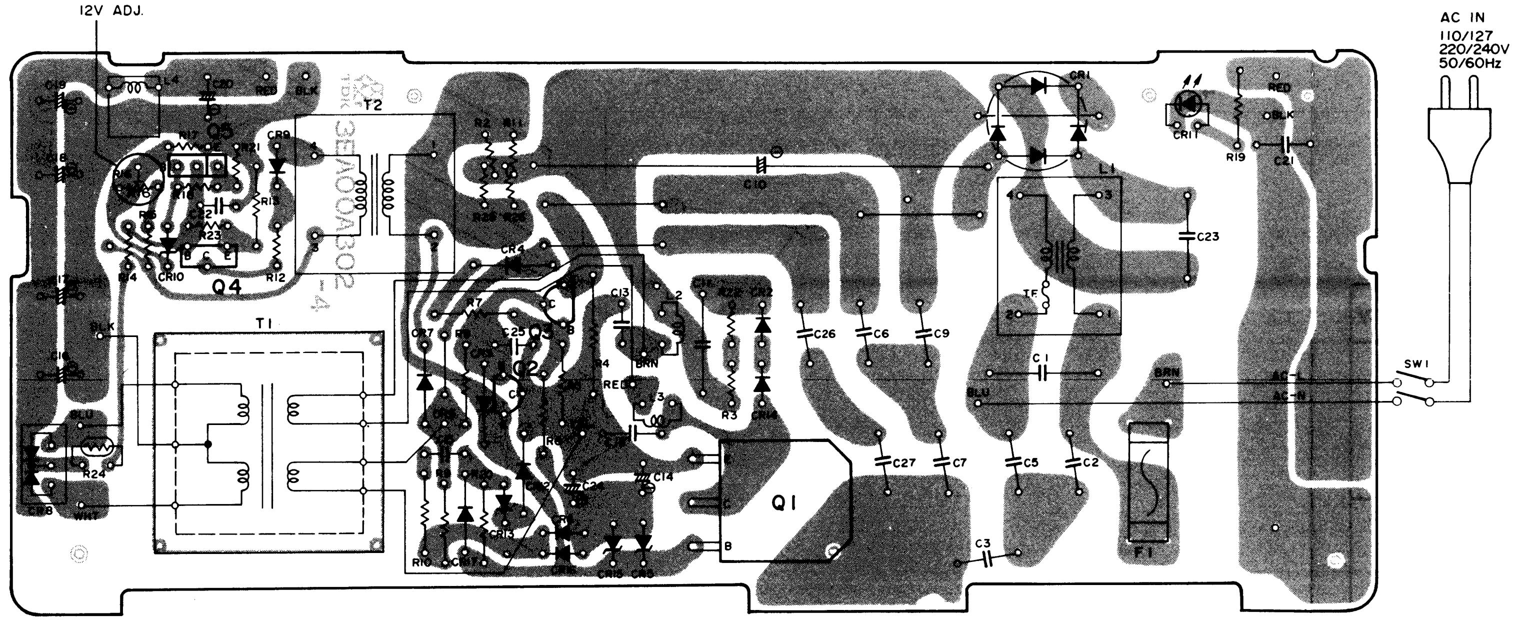
   When the output voltage declines, the voltage at both ends of C14 decreases. Q3 switches on at the lower output current.

SECTION 4
SCHEMATIC AND CIRCUIT BOARD DIAGRAM

4.1 AC POWER PACK SCHEMATIC DIAGRAM


A
B
C
D
E
F
G
H
1
2
3
4
5
PRIMARY
SECONDARY
AC - P3EG
AC - P3EK
BRN
BLU
AC-L
AC-N
SW1
PU53217-169
F1 T 1A
C1 0.047/250
C2 2200P/400
C5 2200P/400
L1
TF
C23 0.022/250
CR1 W06
300
AC215
C3 2200P/400
C9 2200P/400
C10 100/400
C6 2200P/400
C7 2200P/400
PRIMARY GND.
R2 680K
R11 680K
R25 680K
R26 680K
C11 0.01/630
R3 82K 1W
R22 82K 1W
AC149
CR2 RGP10M
CR14 RGP10M
Q1 2SC3153 or 2SC2792
298
-0.1
0
L2 15μH
L3 15μH
BRN
T1
RED
YEL
ORG
AC6.7
C12 680P/1K
C13 0.01/400
CR3 1SS118
Q2 2SA1020Y
C25 1000P/50
-0.2
CR15 RD8.2 FB2
CR5 RD8.2 FB2
R4 0.47 1W
R5 56
C14 33/25
C24 33/25
Q3 2SC1959Y
-0.5
-0.2
R6 620
CR16 1SS118
CR13 1SS118
CR12 1SS118
R8 3.3K
R7 910
CR6 1SS118
CR4 1SS118
R9 2.7
R10 22
C15 0.015/50
R20 47
CR17 1SS118
CR7 1SS118
C26 2200P/400
C27 2200P/400
T2
AC6.6
AC83.8
BLU
WHT
BLK
AC10.9
AC10.9
CR8 ESAB82-004
C16 220/25
C17 220/25
C18 220/25
C19 220/25
L4 3μ
C20 220/25
R19 2.2K
CR11 TLR106
C21 0.1/50
12V
0V
R24
R15 1.5K
R16 2K
12V ADJ
R14 4.7K
Q4 2SC2752L
38.9
0.7
Q5 2SC1815Y
1.4
R12 470
R23 2.2K
0.1
R13 100
CR9 RGP 10J
C22 100P/50
R21 180
R18 2.2K
R17 8.2K
CR10 RD8.2EB2
SECONDARY GND.

4.2 AC POWER PACK CIRCUIT BOARD

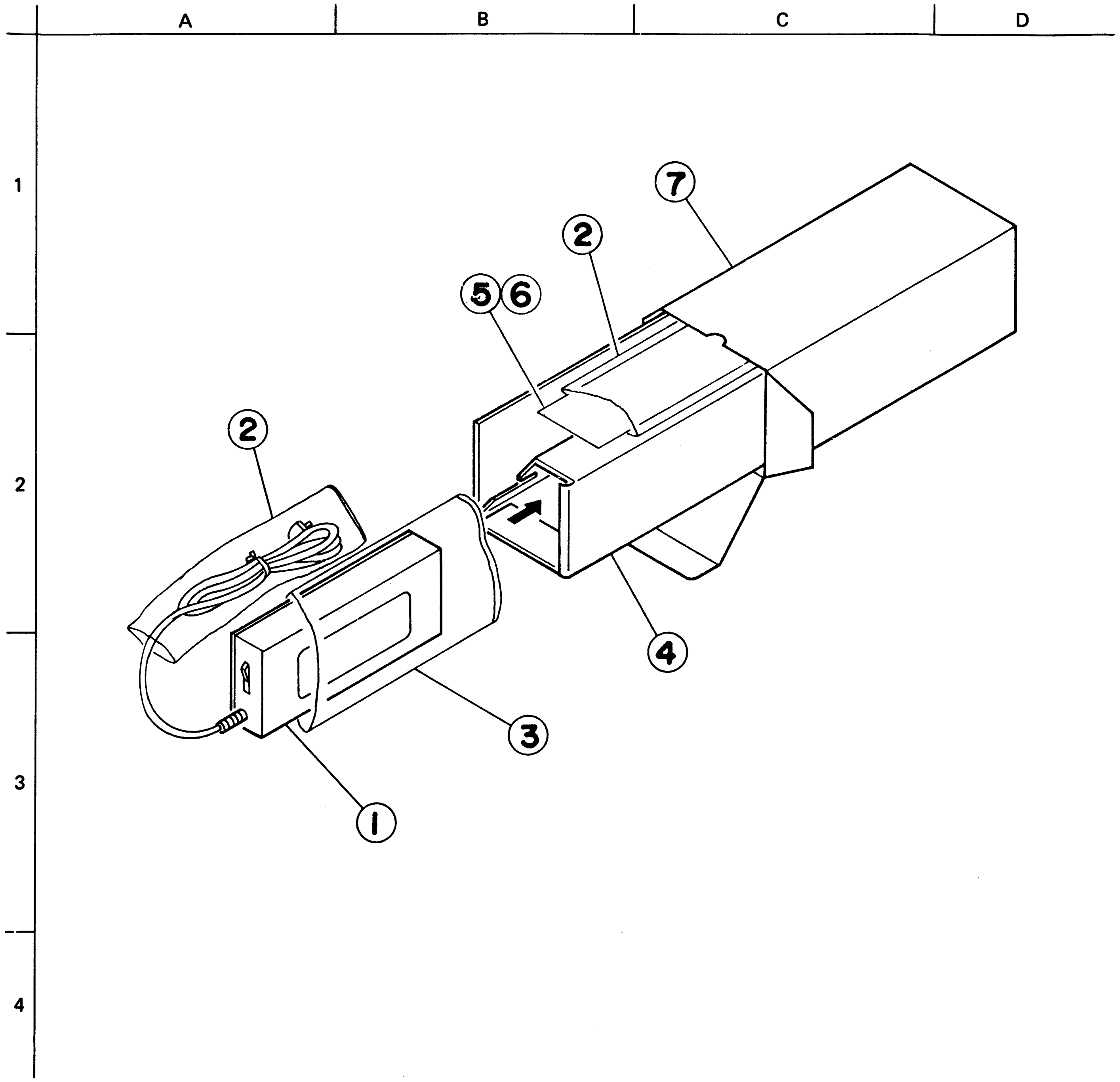

12V ADJ.
AC IN
110/127
220/240V
50/60Hz
T2
T1
Q4
Q1
R2
R11
R25
R26
C10
CR1
L1
C23
C26
C6
C9
C1
C27
C7
C5
C2
C3
F1
SW1
AC-L
AC-N
BRN
BLU
RED
BLK
WHT
CR11
R19
C21
R24
R12
CR10
C13
C25
CR4
CR7
R3
CR5
CR15
R10

NOTE: Unless otherwise specified;

1. All resistance values are in ohms (1/4 W).
2. Do not allow the output voltage to exceed 12.4 V.
3. To measure voltages at T1 primary side, measure PRIMARY GND lines.
   At T1 secondary, measure SECONDARY GND lines.
4. Shaded (▨) parts are critical for safety.
   Replace only with specified part numbers.
5. Voltages are DC-measured with a digital voltmeter.

SECTION 5
EXPLODED VIEWS AND PARTS LIST

5.1 PACKING ASSEMBLY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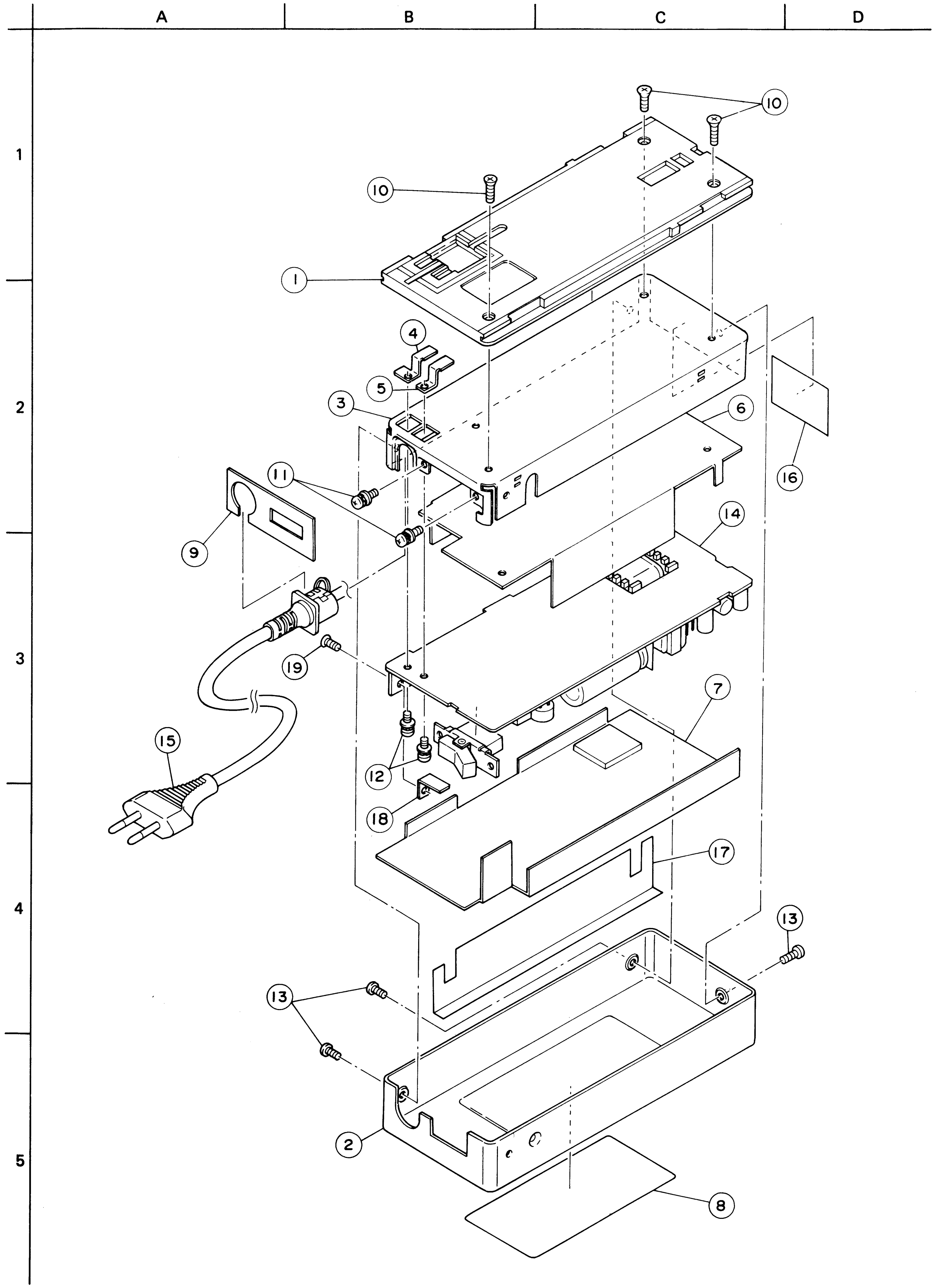
– Packing assembly list –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	–	Power Supply Unit	AC-P3E	3-B	1
2	QPGA007-04003	Poly Bag		2-A	1
3	PU53217-027	"		3-B	1
4	" -047	Packing		3-C	1
⚠ 5	PU30425-518	Instructions		1-B	1
6	–	–	EG	–	–
⚠	PU32004	Warranty Card	EK	1-B	1
7	PU53217-048	Packing Case	EG	1-C	1
	" -054	"	EK		1

5.2 AC POWER PACK ASSEMBLY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– AC power pack assembly list –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
⚠ 1	PU53217-005	Frame		1-B, 2-B	1
⚠ 2	" -036	Cover		5-B	1
3	" -037	Shield Plate		2-B	1
4	" -038	Contact Shoe		2-B	1
5	" -039	"		2-B	1
⚠ 6	" -040	Insulator		2-C	1
⚠ 7	" -041	"		3-C	1
⚠ 8	" -042	Rating Label	EG	5-C	1
⚠	" -053	"	EK		1
9	" -043	Label		3-A	1
10	" -011	Screw		1-B, 1-C	1
⚠ 11	" -010	"		2-A, 2-B	1
⚠ 12	" -009	"		3-B	1
13	" -008	"		4-A, 4-D	1
⚠ 14	–	AC Power Pack P.W.B. Ass'y	See Section 6	2-C	1
⚠ 15	" -044	AC Power Cord	EG	3-A	1
⚠	" -052	"	EK		1
16	" -045	Insulator		2-D	1
17	" -046	"		4-C	1
18	" -206	Holder		4-B	1
19	SSBP3006N	Screw		3-B	1

SECTION 6
ELECTRICAL PARTS LIST

AC Power Pack P.W.B. Ass'y PU53217-217

Symbol No.	Part No.	Part Name	Recommended Parts/ Description
Q 1	2SC3153	Transistor	
Q 2	2SA1020Y	"	
Q 3	2SC1959Y	"	
Q 4	2SC2752L	"	
Q 5	2SC1815Y	"	
CR 1	WO6	Diode	
CR 2	RGP10M	"	
CR 3	1SS118	"	
CR 4	"	"	
CR 5	RD8.2FB2	Zener Diode	
CR 6	1SS118	Diode	
CR 7	"	"	
CR 8	ESAB82-004	"	
CR 9	RGP10J	"	
CR10	RD8.2EB2	Zener Diode	
CR11	TLR106	LED	
CR12	1SS118	Diode	
CR13	"	"	
CR14	RGP10M	"	
CR15	RD8.2FB2	Zener Diode	
CR16	1SS118	Diode	
CR17	"	"	
R 1	–	–	
⚠R 2	PU53217-181	Resistor	680 K 1/2 W
⚠R 3	" -182	"	82 K 1 W
R 4	" -183	"	0.47 "
R 5	" -184	"	56
R 6	" -185	"	620
R 7	" -186	"	910
R 8	" -187	"	3.3 K
⚠R 9	" -188	"	2.7
R10	" -189	"	22
⚠R11	" -181	"	680 K 1/2 W
R12	" -190	"	470
R13	" -191	"	100
R14	" -192	"	4.7 K
R15	" -193	"	1.5 K
R16	" -194	VR	2 K
R17	" -195	Resistor	8.2 K
R18	" -196	"	2.2 K
R19	" -197	"	2.2 K
R20	" -198	"	47
R21	" -199	"	180
⚠R22	" -182	"	82 K 1 W
R23	" -196	"	2.2 K
⚠R24	" -200	Posistor	
⚠R25	" -181	Resistor	680 K 1/2 W
⚠R26	" -181	"	680 K "
⚠C 1	PU53217-175	MY Cap	0.047 250 V
⚠C 2	" -176	"	2200 P 400 V
⚠C 3	" -176	"	" "
C 4	–	–	
⚠C 5	PU53217-176	MY Cap	2200 P 400 V
⚠C 6	" -176	"	" "
C 7	" -176	"	" "

Symbol No.	Part No.	Part Name	Recommended Parts/ Description
C 8	–	–	
⚠C 9	PU53217-176	MY Cap	2200 P 400 V
⚠C10	QET22GR-107	E Cap	100 "
C11	QFH42JK-103	MM Cap	0.01 630 V
C12	QCY43AK-681	C Cap	680 P 1000 V
C13	QFM32GK-103	MY Cap	0.01 400 V
C14	QET41EH-336	E Cap	33 25 V
C15	QFM31HK-153	MY Cap	0.015 50 V
C16	PU53217-177	E Cap	220 25 V
C17	" -177	"	" "
C18	" -177	"	" "
C19	" -177	"	" "
C20	QET41EM-227	"	" "
C21	QFM31HK-104	MY Cap	0.1 50 V
C22	QCS11HJ-101	C Cap	100 P "
⚠C23	PU53217-178	MY Cap	0.022 250 V
C24	QET41EH-336	E Cap	33 25 V
C25	QFM31HK-102	MY Cap	1000 P 50 V
⚠C26	PU53217-176	"	2200 P 400 V
⚠C27	" -176	"	" "
⚠L 1	PU53217-167	Choke Coil	10 mH
L 2	" -131	"	15 μH
L 3	" -131	"	15 μH
L 4	" -132	"	3 μH
⚠T 1	PU53217-165	Transformer	
⚠T 2	" -166	"	
⚠F 1	PU53217-169	Fuse	
⚠	" -170	Fuse Holder	
⚠SW 1	PU53217-168	Switch	POWER Switch
⚠	PU53217-179	Cap Cover	
⚠	PU53217-202	Heat Sink	
	" -212	Insulator	
⚠	PU53217-203	Heat Sink	for Q1
	" -205	Bracket	"
⚠	" -207	Transistor Holder	"
⚠	" -208	Insulator	"
⚠	" -209	"	"
⚠	" -210	"	"
	" -213	Bolt	"
⚠	" -010	Screw	"
⚠	SSBP3006N	"	"
⚠	WSB3000N	Washer	"
⚠	WLP3000N	Spring Washer	"
⚠	NNB3000N	Nut	"
⚠	PU53217-215	Tube	"
	PU53217-204	Heat Sink	for CR8
	" -211	Insulator	"
	" -153	Plate	"
	" -150	Bolt	"
⚠	SSBP3012N	Screw	"
⚠	WSB3000N	Washer	"
⚠	WLP3000N	Spring Washer	"
⚠	NNB3000N	Nut	"
⚠	PU53217-216	Bushing	"

No. 8260(4/5)

JVC Service Manual

JVC
CAR BATTERY ADAPTER
MODEL NO. AP-P3E
12V ⎓ 5A
FUSE T5A

MODEL AP-P3E

VICTOR COMPANY OF JAPAN, LIMITED

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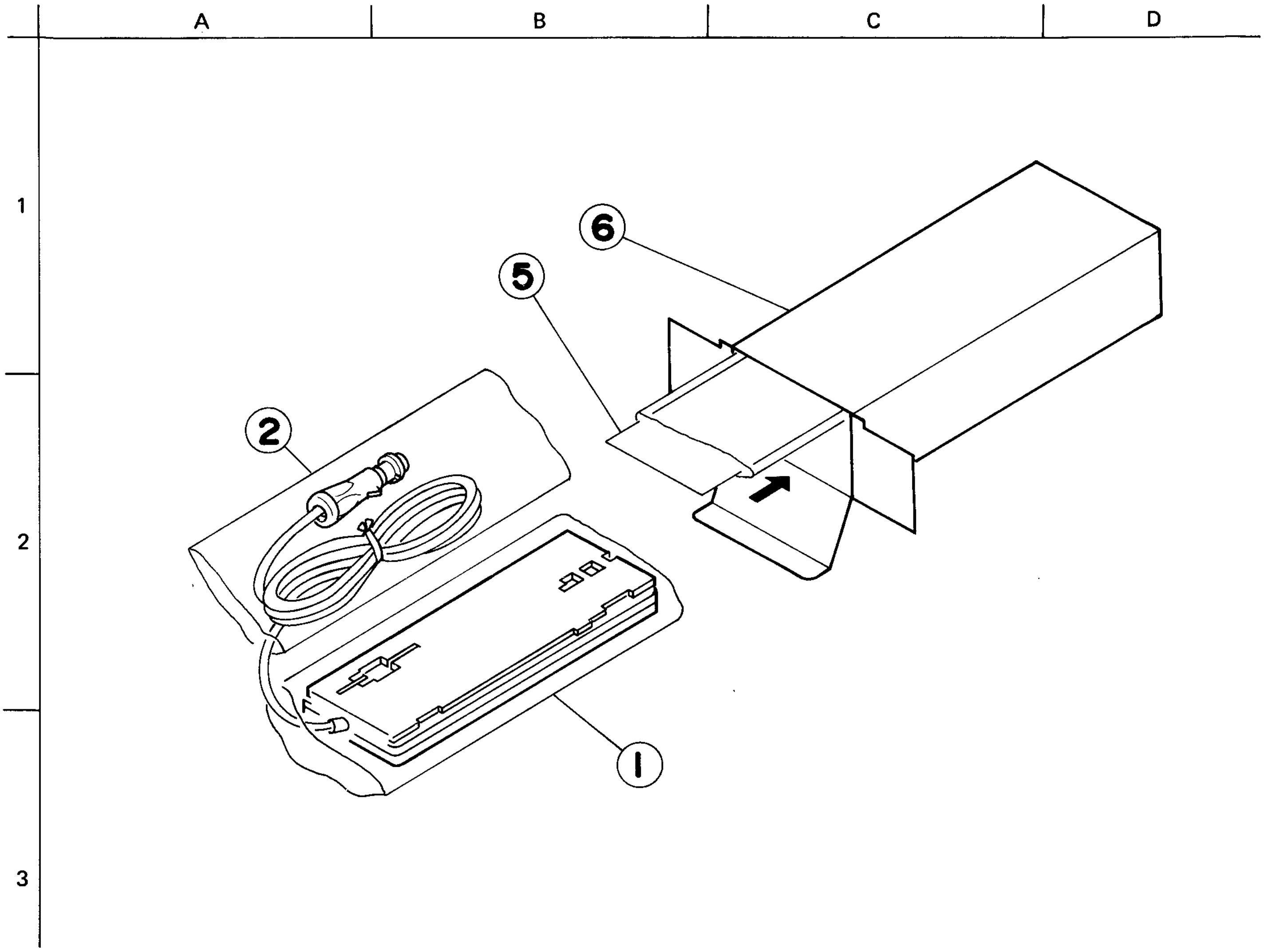
EXPLODED VIEW AND PARTS LIST

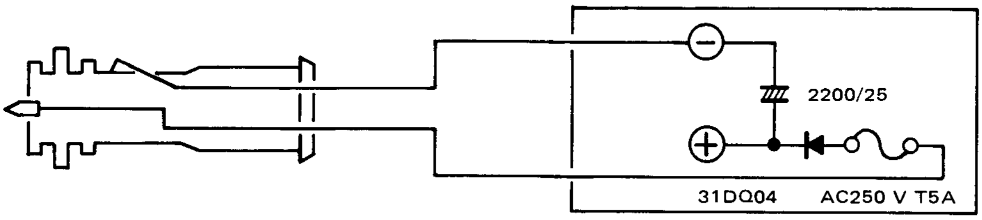
– PACKING ASSEMBLY –



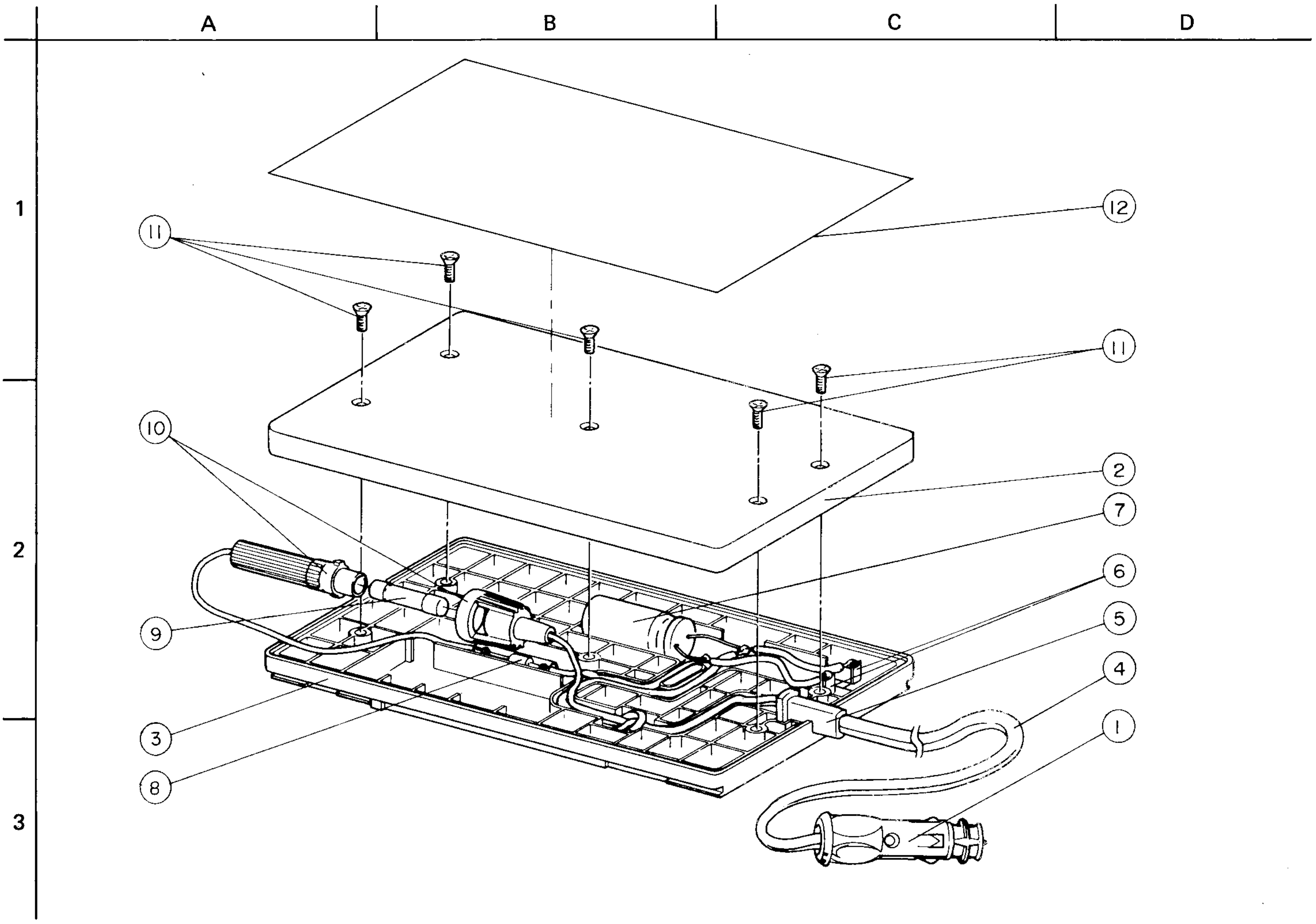
– Packing assembly list –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	QPGA015-02505	Poly Bag		3-B	1
2	″ -02505	″		2-A	1
3	–	–		—	–
4	–	–		—	–
5	PU30425-519	Instructions		1-B	1
6	PU53924-046	Packing Case		1-B	1

– AP-P3E SCHEMATIC DIAGRAM –


2200/25
31DQ04
AC250 V T5A

– CAR BATTERY ADAPTER ASSEMBLY –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– Car Battery Adapter Assembly List –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	PU53924-049	Car Battery Plug		3-D	1
2	″ -056	Upper Case Ass'y		2-D	1
3	″ -057	Lower Case Ass'y		3-A	1
4	″ -053	Cord		2-D	1
5	″ -009	Cord Bush		2-D	1
6	PU53925	Contact Shoe		2-D	2
7	QET61EM-228	E Cap		2-D	1
8	31DQ04	Diode		3-A	1
9	QMF51A2-5R0	Fuse	AC250 V T5A	2-A	1
10	PU53924-050	Fuse Holder		2-A	1
11	SSSB2615M	Tapping Screw		1-A, 1-D	5
12	PU53924-048	Label		1-D	1

INSTRUCTIONS

MANUEL D'INSTRUCTIONS/BEDIENUNGSANLEITUNG

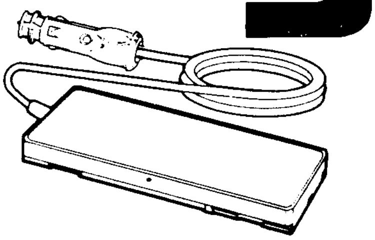
JVC

AP-P3

CAR BATTERY ADAPTER

ADAPTATEUR POUR BATTERIE AUTOMOBILE

AUTOBATTERIE-ADAPTER



Specifically for the AP-P3E
Spécial pour le AP-P3E
Bedienungsanleitung für das Modell AP-P3E.

PU30425-519

Thank you for purchasing the JVC AP-P3E Car Battery Adapter. The AP-P3E is for use exclusively with the JVC HR-C3 Compact Video Cassette Recorder. To avoid problems and obtain the best results, please read this instruction booklet carefully before use.

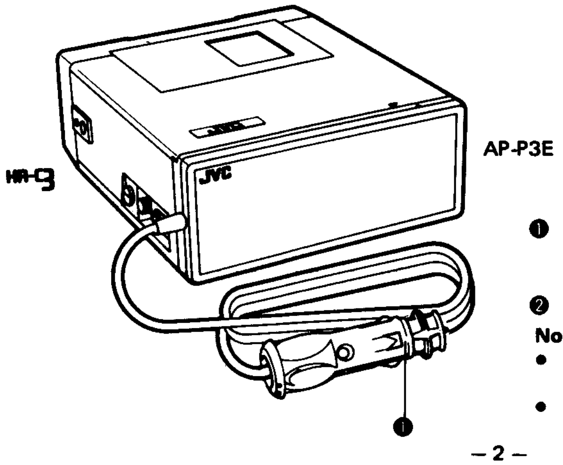
WARNING:
TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS UNIT TO RAIN OR MOISTURE.
This unit should be used with 12 V ⎓ only.
CAUTION:
To prevent electric shocks and fire hazards, do NOT use any other power source.

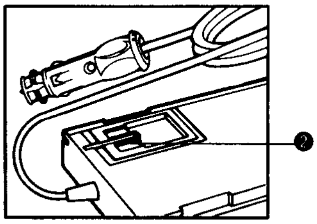
NOTE:
The rating plate is on the bottom of the unit.

PRECAUTIONS

- Prevent water from entering the unit.
- Do not disassemble or modify the unit, as this will cause danger and malfunctioning.
- Avoid using the unit in places subject to direct sunlight, excessive humidity and vibrations.

IDENTIFICATION





① **Cigarette lighter plug**
Insert into the cigarette lighter socket of your car.

② **Terminals**

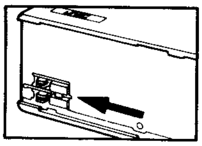
Notes:

- DO NOT short-circuit the terminals when the power cord is plugged in.
- Always keep the terminals clean. If they become dirty, wipe them with a piece of soft cloth.

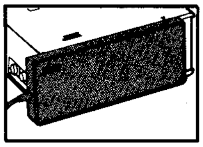
OPERATION

CAUTION:
When sliding the adapter on and off the HR-C3, make sure that the HR-C3's POWER switch is set to OFF.

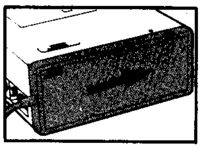
To attach



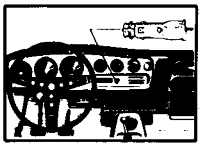
The terminals on the rear of the HR-C3 are covered by the terminal cover, which is automatically opened and closed by sliding the adapter on and off the HR-C3. If the terminal cover is out of place and the terminals are exposed, attaching the adapter is impossible. Slide the cover in the direction of the arrow, if necessary.



1. Align the marks.

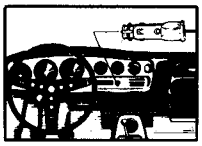


2. Slide in the direction of the arrow until it locks in place.

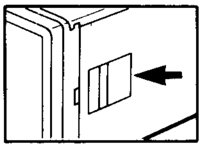


3. Plug into the car's cigarette lighter socket. Keep the car engine idling. Pressing the POWER button of the HR-C3 will switch on the power.

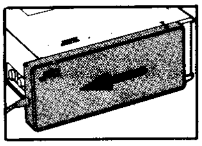
To remove



1. Remove the plug from the cigarette lighter socket.

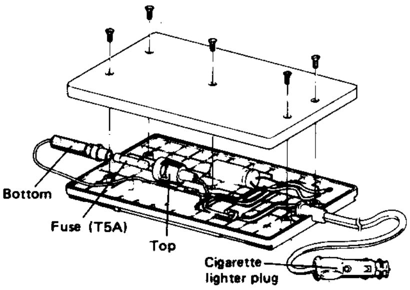


2. While pressing the release button on the HR-C3 . . .



3. . . . slide the adapter off.

HOW TO REPLACE THE FUSE



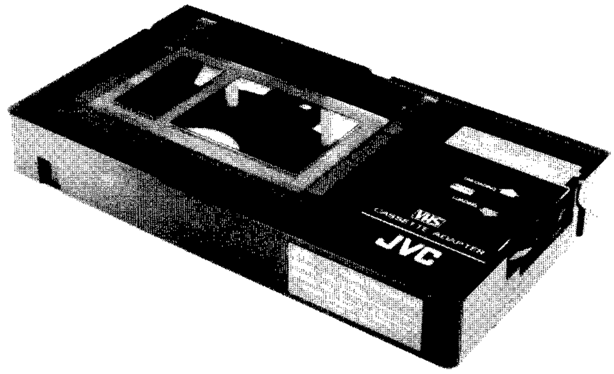
1. Loosen the five screws and remove the cover.
2. Slightly lift the fuse holder.
3. While pushing both ends of the fuse holder together, turn the top counterclockwise to open.
4. Replace the fuse with a new one (T5A).
5. Reassemble the fuse holder by aligning the bosses of the bottom section with the recesses of the top, push the two sections together, and turn the top clockwise.
6. Reposition the fuse holder in its recess and replace the cover.

AP-P3E SPECIFICATIONS

Input	: 12 V ⎓ (negative-grounded cars only)
Dimensions	: 179(W) x 20(H) x 74(D)mm (7-1/16" x 11/16" x 2-15/16")
Weight	: 300 g (0.67 lb)

No. 8260(5/5)

JVC Service Manual


VHS
CASSETTE ADAPTER
JVC

MODEL C-P2U

VICTOR COMPANY OF JAPAN, LIMITED

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Printed in Japan

INSTRUCTIONS

MANUEL D'INSTRUCTIONS/BEDIENUNGSANLEITUNG

JVC

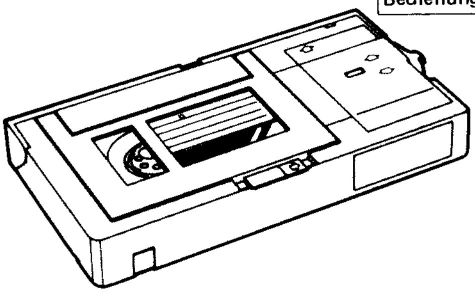
C-P2

CASSETTE ADAPTER

ADAPTATEUR DE CASSETTE
CASSETTEN-ADAPTER

VHS

Specifically for the C-P2U/S
Spécial pour le C-P2U/S
Bedienungsanleitung für das Modell C-P2U/S



PU30425-515

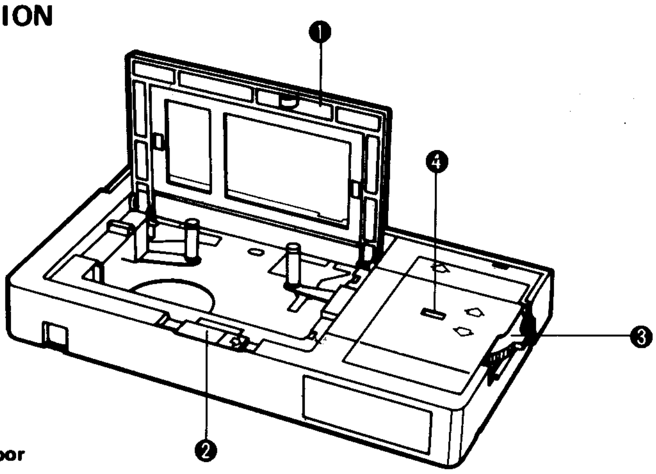
JVC

VICTOR COMPANY OF JAPAN, LIMITED

OCT2 U/S Printed in Japan
PU30425-515

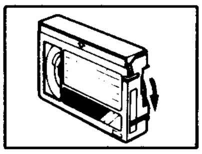
Thank you for purchasing the JVC C-P2U/S VHS Cassette Adapter. This adapter enables a compact video cassette carrying the VHS C mark to be recorded and played back on any video recorder carrying the VHS mark. To avoid problems and obtain the best results, please read this instruction booklet carefully before use.

IDENTIFICATION

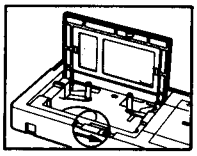


- ❶ **Compartment door**
- ❷ **Sliding latch**
- ❸ **Loading gear**
- ❹ **Loading/Unloading indicator window**

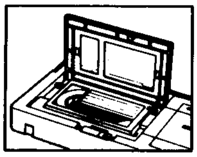
INSERTING A COMPACT VIDEO CASSETTE



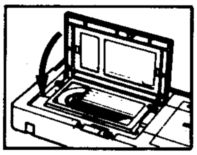
Note:
If there is slack in the video tape when inserting the compact cassette into the adapter, the tape may become damaged. To take up slack in the tape, turn the gear in the direction of the arrow.



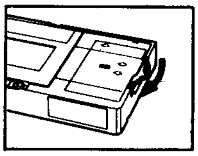
1. Push the sliding latch ❷ in the direction of the arrow to open the compartment door.



2. Insert the compact video cassette into the adapter as shown in the diagram.

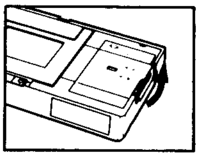


3. Close the compartment door.

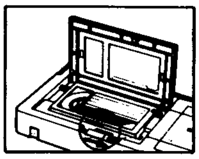


4. Turn the loading gear ❸ gently in the direction of the blue LOADING (CHARGER) arrow until the indicator window is completely blue.

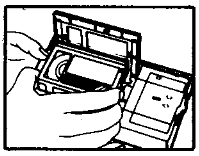
REMOVING THE COMPACT VIDEO CASSETTE



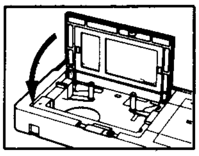
1. Turn the loading gear ❸ in the direction of the red UNLOADING (DE-CHARGER) arrow until the indicator window is completely red.



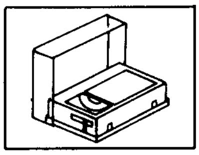
2. Push the sliding latch ❷ in the direction of the arrow to open the compartment door.



3. Using the smaller hole on the underside of the adapter, push the cassette up from below and remove it.



4. Close the compartment door.



5. Put the compact cassette in its case for storage.

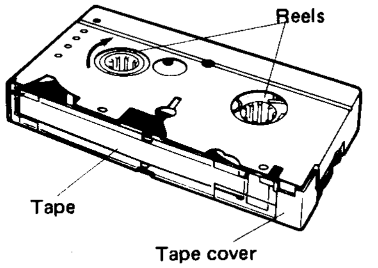
Notes:
- The loading gear cannot be turned without a compact cassette in the compartment.
- Unless the indicator window is completely red, the sliding latch will not move even when pushed.

SPECIFICATIONS

Type : VHS cassette adapter
Dimensions : 188(W) x 25(H) x 104(D) mm (7-7/16" x 1" x 4-1/8")
Weight : 205 g (0.45 lb.)

CAUTION

Check the tape condition after inserting the cassette and loading the tape:
1) Check to see if there is any tape slack. (Do not open the tape cover.)
2) If there is tape slack, remove it by turning the reel in the direction of the arrow.



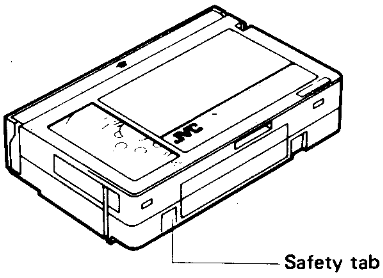
Note
During special-effects playback (slow motion, still frame, etc.) the picture may vibrate or noise bars may appear on the screen.

Design and specifications subject to change without notice.

PRECAUTIONS

- This cassette adapter is precision-manufactured. Avoid violent vibrations or shocks. Do not drop or disassemble or modify it, otherwise malfunctions may result.
- Do not load and unload the cassette adapter repeatedly without allowing the tape to run. This will slacken the tape and thereby damage it.
- The cassette adapter cannot be loaded upside down.
- Do not touch the tape when inserting a compact cassette into this cassette adapter. After use, remove the cassette from the adapter.
- Avoid exposing the cassette to direct sunlight. Keep away from heaters.
- Avoid strong magnetic fields (such as those near TV Sets or Speakers).
- Avoid extreme humidity when selecting a storage location.
- Avoid dusty places.

Compact video cassette



Note:
VHS C compact video cassettes are equipped with a safety tab to prevent accidental erasure. Break and remove this safety tab from not-to-be-erased cassettes. If you install a cassette whose safety tab has been removed into this adapter, recording cannot be performed. If you wish to record on a cassette whose safety tab has been removed, reseal the slot with cellophane tape.

SECTION 1
MECHANICAL ADJUSTMENT

1.1 MAIN ASSEMBLY REPLACEMENT

1.1.1 Handling precautions

1. Take-up guide pole lever assembly ④ , supply guide pole assembly ⑪ and gear unit assembly ㉘ are very critical parts. Be extremely cautions when handling them.
2. Do not disassemble the gear unit assembly ㉘ .

1.1.2 Removing the bottom plate assembly

1. Remove the nine screws ㉝ from the bottom.
2. To remove the bottom plate, lift it upwards.

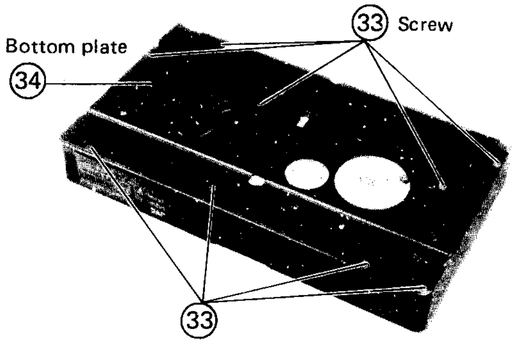


Fig. 1-1

1.1.3 Take-up guide pole lever assembly ④

1. With guide poles in the UNLOADING position, remove screws ⑤ and ⑨.
2. To remove the take-up guide pole lever assembly, first remove "E" washer ⑩ and then remove the spring from Ⓑ.

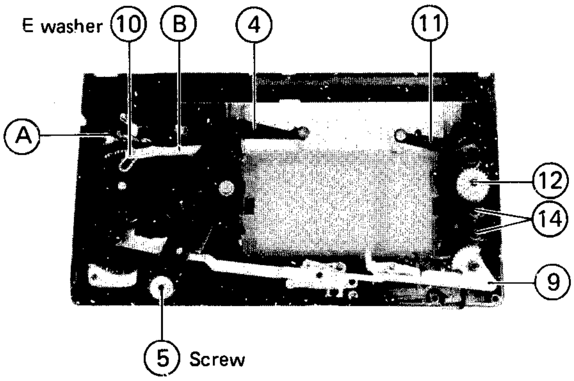


Fig. 1-2

3. To reassemble, attach the spring to Ⓑ and then follow the steps above in reverse.

1.1.4 Supply guide pole lever assembly ⑪ and clutch gear assembly ⑫

1. To remove the supply guide pole lever assembly ⑪ , lift it upwards.
   To remove the clutch gear assembly ⑫ , remove the T spring ⑬ and lift upwards.
2. To attach the clutch gear assembly ⑫ , make sure the take-up guide pole lever assembly ④ is in the UNLOADING position. To bring the stud to which the T spring ⑬ is to be attached to the position shown in Fig. 1-3, mesh the clutch gear assembly with the idler gears ⑭ . After having installed the supply guide pole lever assembly ⑪ , attach the T spring ⑬ to the stud.
3. To install the supply guide pole lever assembly ⑪ properly, the take-up guide pole ④ must be in the UNLOADING position.
   Hold the supply guide pole lever assembly ⑪ so that its edge Ⓒ is parallel to the lid ② and engage it with the clutch gear assembly ⑫ .
4. Before attaching T spring ⑬ to the stud on the clutch gear assembly ⑫ , check to see whether the supply guide pole has a play of 5—10 mm. If there is not, shift the engagement of supply guide pole lever assembly ⑪ and clutch gear assembly ⑫ by one tooth.

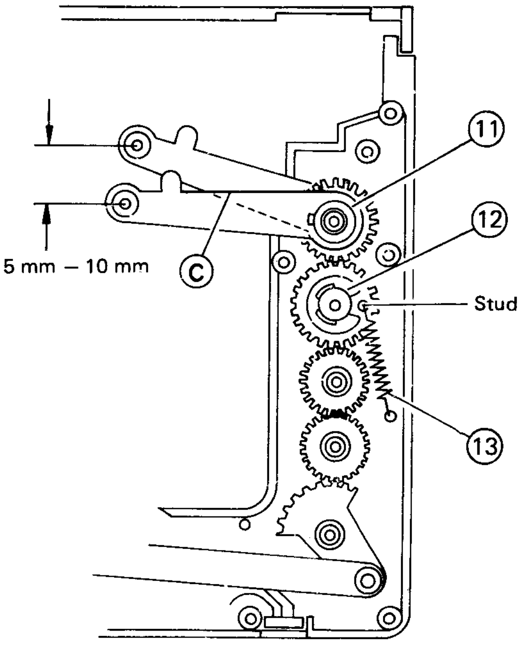


Fig. 1-3

1.1.5 Gear unit assembly ㉘

1. Remove the take-up guide pole lever assembly ④.
2. Remove the torsion spring ③ and rod from the stud of the lid ② and remove the four screws ㉙.
3. While pushing the lock arm in the direction of the arrow, rotate the entire gear unit assembly clockwise and lift it upwards to remove it. When doing this, be careful not to bend the shaft of the first idler ㉖.

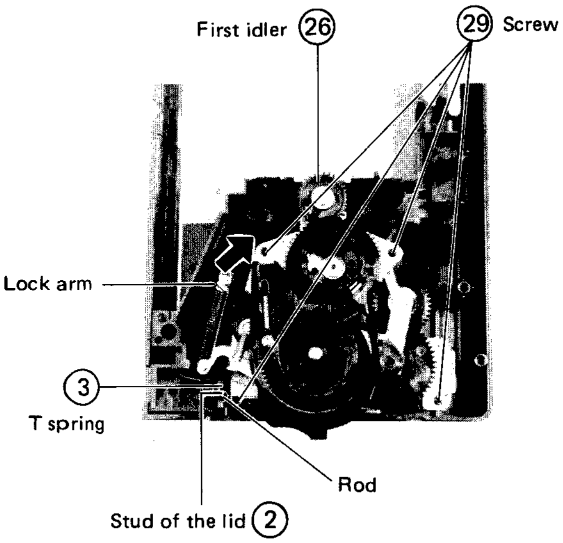


Fig. 1-4

4. To reassemble, perform the exact steps above in reverse; to prevent the rod from disengaging from the stud of lid ②, make sure the end of the torsion spring ③ lies on top of the rod.

1.1.6 Attaching the bottom plate assembly

1. The bottom plate is attached by the nine screws ㉝. To prevent the supply guide pole lever ⑪ from being caught on the stud located on the reverse side of the bottom plate, tighten the nine screws while keeping the bottom plate pressed down firmly in the area of the stud and supply guide pole lever.

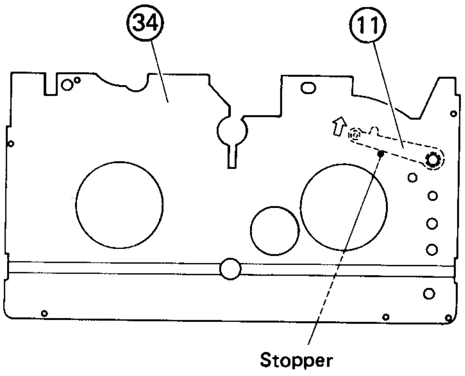


Fig. 1-5

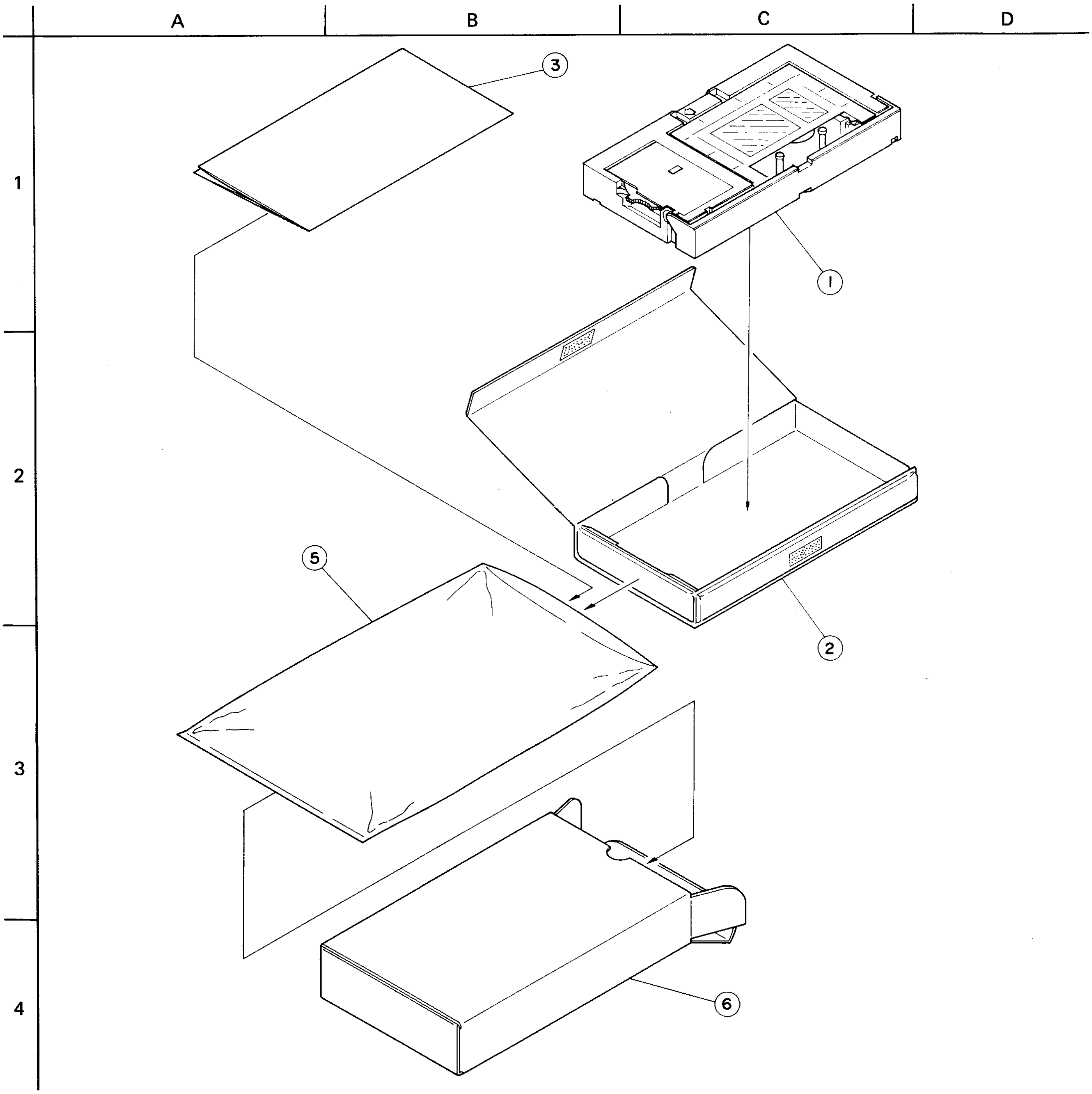
1.2 CHECK POINTS AFTER ASSEMBLING

1. Check the guide poles for perpendicularity.
   Without inserting a compact video cassette into the adapter, set the adapter to the LOADING position. Close the cassette door ㉟ and by pressing the cassette detect lever ㉑, it can be set to the LOADING position. Open the lid ② and observe both the take-up and supply guide poles. Check that their boss and the upper flange are completely flush against the adapter frame.

   Note: Do not force the adapter into the LOADING position, without pressing the cassette detect lever ㉑.
2. Check the operation of the take-up reel brake.
   Make sure that the take-up reel moves away from the brake pad when lid ② is opened and comes into contact with it when the lid is closed so that the brake functions properly.
3. **After completely assembling the adapter, actually load a compact video cassette, place the loaded adapter into a VHS recorder, operate the recorder's FF, REW, PLAY, SEARCH and PAUSE functions repeatedly, and check to see whether the tape is running stably without being damaged.**

SECTION 2
EXPLODED VIEWS AND PARTS LIST

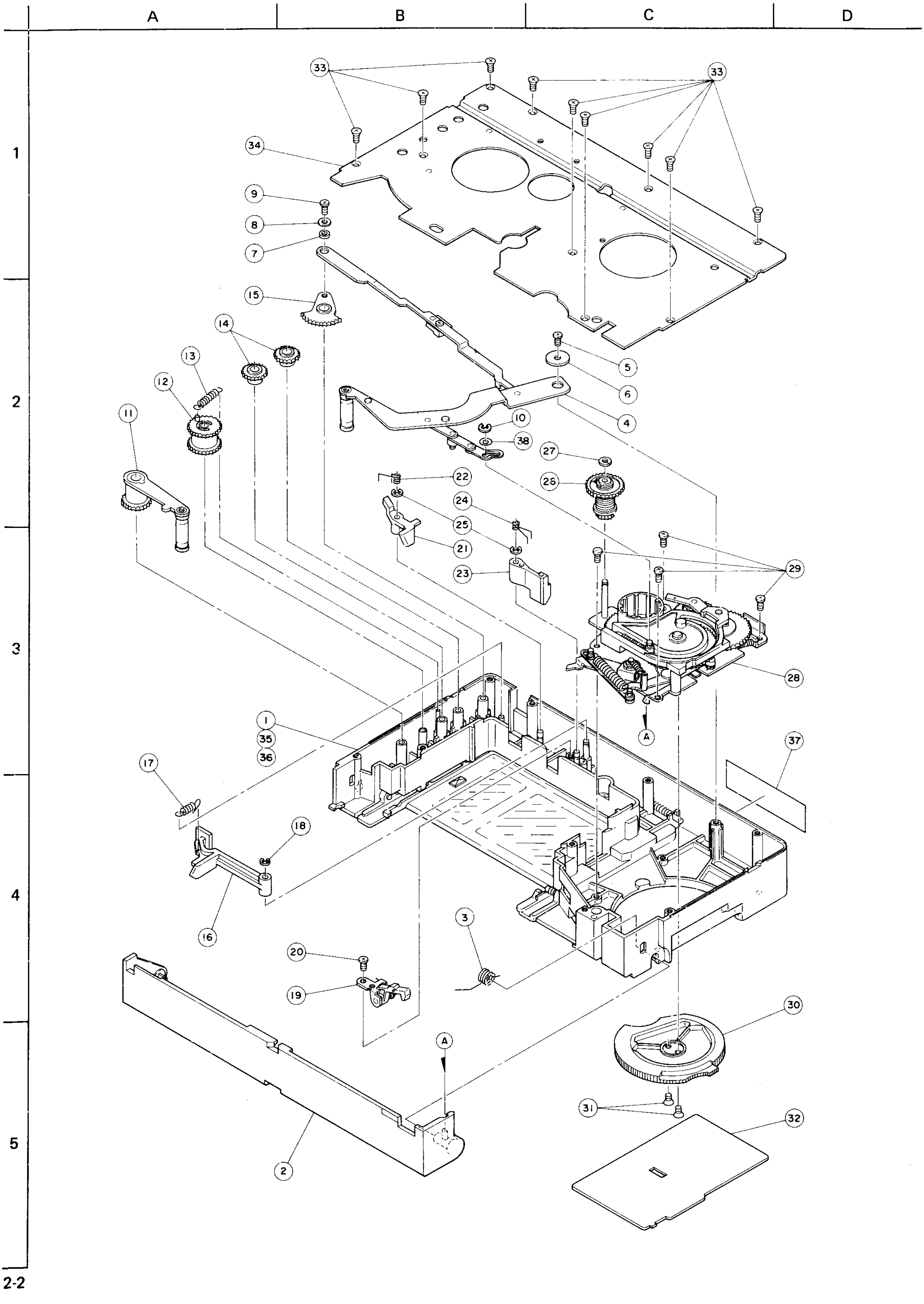
2.1 PACKING ASSEMBLY



– Packing assembly list –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	–	C-P2U		1-C	1
2	PU54470-2	Case		3-C	1
3	PU30425-515	Instractions		1-B	1
4	–	–		–	–
5	QPGA017-03005	Poly Bag		2-A	1
6	PU54170-5	Packing Case		4-C	1

2.2 CASSETTE ADAPTER ASSEMBLY


A
B
C
D
1
2
3
4
5
33
33
34
9
8
7
15
14
13
12
11
5
6
4
10
38
27
26
22
24
25
21
23
29
28
A
1
35
36
37
17
18
16
3
20
19
30
A
31
32
2

– Cassette adapter assembly list –

Symbol No.	Part No.	Part Name	Description	Symbol No. Position	Q'ty
1	PU21424A	Adapter Frame Ass'y	Incl. ㉟ , ㊱	3-A	1
2	PU33666	Lid		5-B	1
3	PU53800	Torsion Spring		4-B	1
4	PU33663	Take-up Guide Pole Lever Ass'y		2-C	1
5	SPSK2004M	Screw		2-C	1
6	Q03091-150	Washer		2-C	1
7	PUM30005-21	Collar		1-A	1
8	WNB2000	Washer		1-A	1
9	SPSK2004M	Screw		1-A	1
10	REE2000	E. Washer		2-B	1
11	PU53734A	Supply Guide Pole Lever Ass'y		2-A	1
12	PU53741A	Clutch Gear Ass'y		2-A	1
13	PU54831	T. Spring		2-A	1
14	PU53746	Idler Gear		2-A	2
15	PU53747	Connect Gear		2-A	1
16	PU53756	Rec. Lever		4-A	1
17	PUM30001-101	T. Spring		3-A	1
18	REE1500	E. Washer		4-B	1
19	PU53754A	Bracket Ass'y		4-B	1
20	SPSK2004M	Screw		4-B	1
21	PU53750	Cassette Detect Lever		3-B	1
22	PU53751	Torsion Spring		2-B	1
23	PU53752	Stopper		3-B	1
24	PU53753	Torsion Spring		2-B	1
25	REE1500	E. Washer		2-B	2
26	PU53793A	First Idler Ass'y		2-C	1
27	PUM30017-1	Slit Washer		2-C	1
28	PU54976A	Gear Unit Ass'y	Incl. ㉖ , ㉗	3-D	1
29	SPSK2004M	Screw		3-D	4
30	PU54977A	Operation Knob Ass'y		4-D	1
31	SSSP2003M	Screw		5-C	2
32	PU53802-2	Instruction Plate		5-D	1
33	SSSP2005M	Screw		1-B, 1-C	9
34	PU33668A	Bottom Plate Ass'y		1-A	1
35	PU55004	Cassette Door Ass'y		3-A	1
36	PU53801	Torsion Spring		3-A	1
37	PU54116-5	Serial No. Plate		3-D	1
38	WSS2600Z	Spacer		2-B	1